Securing Continuous Records of Insulation Condition—*Characteristics of and Field for Different Types of Oil Engines* and the regular departments

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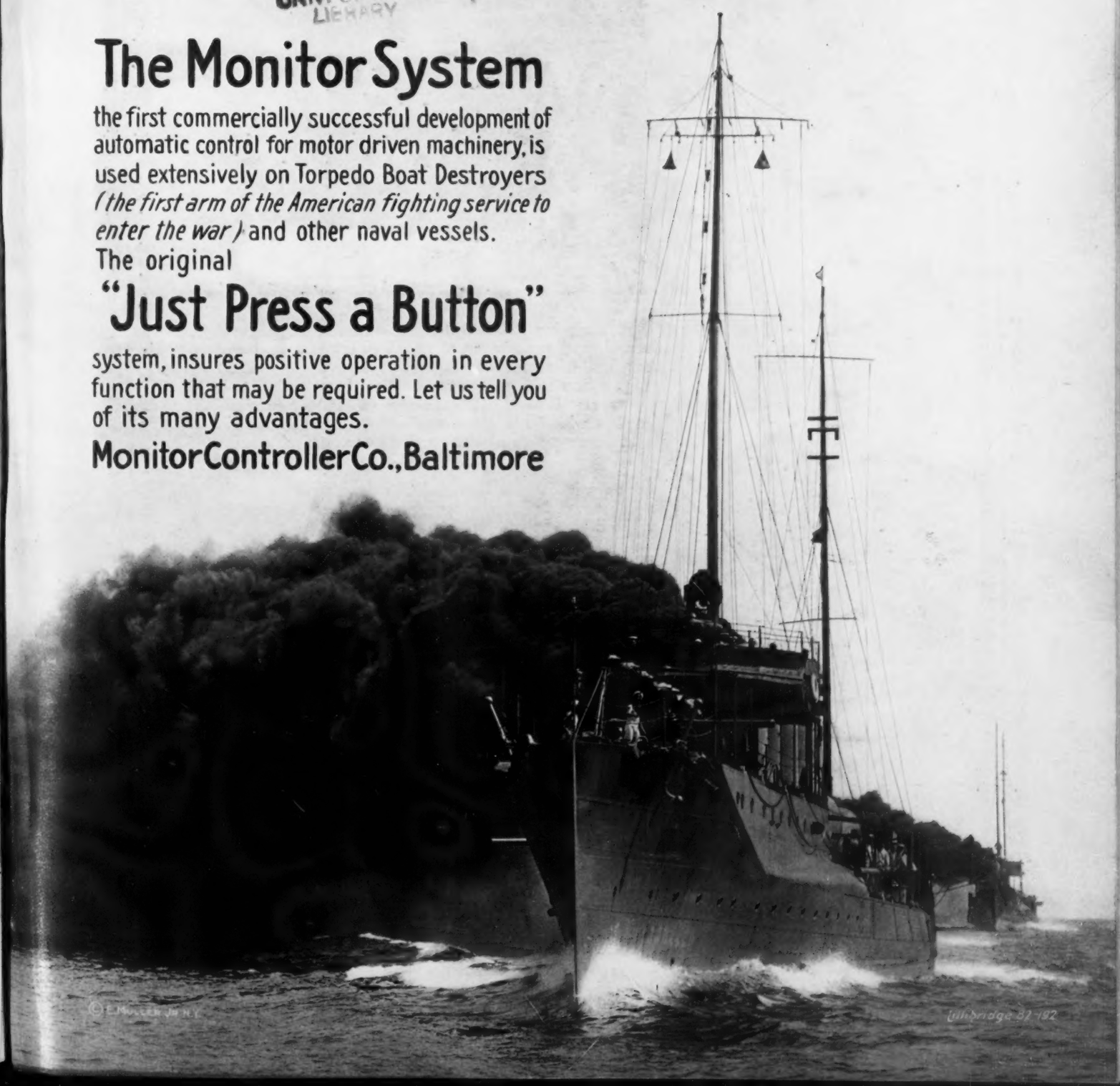

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Co-ordination with Electrical Contractors

FORMATION by the larger electrical contracting companies of "the Conference Club," described elsewhere in this issue, is of far-reaching importance in the closer organization of the industry. It is a step toward the finely knit co-ordination of commercial interests which the ELECTRICAL WORLD discussed in its issue of May 19, 1917. It is intended to be, in purpose and execution, a stabilizer for the electrical contracting branch of the industry. So rapid has been the growth of this section of the industry that it faces problems of policy which are distinctively its own to solve. The jobbers have long realized the necessity of a strong central organization; the manufacturers, approaching the solution more slowly, have worked out by evolution the very effective plan of three organizations with representatives serving on a central council. The contractors have their national organization, which well meets the needs of the great body of its members and is supplemented by able local organization. Into this situation the Conference Club has entered as a medium for exchange of views between contractor and manufacturer, for raising the standard and public estimation of the contractor, for taking up large questions and by fair solution giving stability to a business which involves a tremendous annual turnover.

Agricultural Needs of the Far West

THE war has opened up great opportunities in agriculture, and these opportunities are nowhere half so apparent as on the Pacific Coast. There is the soil, there is the climate, and all that is lacking is the rain. The quickest way to get water is to pump it, and west of the Rockies that means by electricity. As a result the power companies have been besieged with demands for more service lines, but the business cannot be taken on because small transformers and motors are not to be had. Interwoven as is the subject of increased crops with the national situation, a remedy ought to be forthcoming quickly. Electricity on the Pacific Coast is the most economical source of power available and, being generated from falling water, there is no waste of fuel involved. Moreover, the lines of the power companies are so interconnected that there is little waste of electricity either. The demand for motors and transformers is about three times normal, but this is offset by a subnormal demand for generating equipment. Animated by a desire to keep down the cost of electricity and still make the supplying of it profitable, co-operation between the electricity supply companies has reached a higher level in California than in any other state in the Union. In fact, by the installation of less than twenty-five miles of transmission line the interconnected network would embrace every important city in the State from Oregon to Mexico. Thus the companies are in a position to supply all demands for energy at minimum cost and with the utmost reliability of service. The tillers of the soil in the great fertile valleys are anxious to do their part in the national crisis; the generating companies are likewise anxious and willing to contribute their share, but the manufacturers of electrical equipment are not equal to the emergency. Crops must be had, and the farmers will find a means for obtaining water by other than electric means if they are driven to it. Gasoline and oil engines are plentiful in California, and there is no dearth of oil there. What we desire particularly to call attention to is that if the necessary motors and transformers are not forthcoming manufacturers will not be the only ones to suffer but very valuable business will be lost to the central stations, jobbers and contractors as well.

A Solution of the Coal Problem

OUR readers will find an excellent summary of the present condition of the oil-engine situation in Prof. A. A. Potter's brief paper. We have discussed the matter repeatedly in these columns from the commercial standpoint, but it is an excellent thing to have the fundamental facts brought together in so clear a form as here. Broadly, the state of the case is this, that there are in use a vast number of small engines using gasoline and the lighter distillates. They are fairly efficient, enormously convenient, and would be even more widely used than at present were it not for the fact that the demand for gasoline and the like has run up the price and will increase it still further in the near future. The result is that this type of engine, which almost universally follows the so-called Otto cycle, is relatively somewhat expensive to run, despite its good thermodynamic properties.

On the other hand, a good many engines of the Diesel type, of capacity running to some hundreds of horsepower each, are employed, using the heavier oils, operating at a high efficiency, and giving excellent economic results. The practical trouble with the Diesel type of engine is its very high initial expense. In rough terms, it costs rather more than a first-class steam plant per horsepower, or perhaps three times as much as the engines of the light-oil or gasoline type. It is complicated and requires not so much constant care as intelligent care. On account of the cheapness of fuel supply in this country, steam engines even of uneconomical

type have been in the past operated at moderate expense, and particularly with very small overhead charges. Consequently, few users of power are keen about installing a type of machinery which, while highly economical, means the investment of a large amount of capital. As solid fuel gets higher in price, the Diesel engine, which from a thermodynamic standpoint is extraordinarily good, would stand a greater and greater chance of more general use. From the commercial standpoint the makers of such engines have not yet put them fairly into competitive relations with steam equipment, so that it may reasonably be expected that the price of the oil engine will be likely to fall somewhat as it becomes more appreciated and more familiar. The time has now come, however, when the cost of coal and the irregularity of supply compel the use of high-economy power-producing plants, whether steam or oil. And therefore we may expect gradually to see the better grade of oil engines come into increasing use, particularly for the units of moderate size for which high-efficiency steam engines are difficult to obtain.

Testing Insulation Under Load

ABILITY to keep continuous record of the insulation strength when a machine is in action gives an insight into its operating conditions that is extremely valuable, and also may give indications of impending trouble in time to avert unpleasant results. The armature insulation of the generator is its weakest point, upon the maintenance of which in standard condition depends the usefulness of the machine. Now, measuring the insulation resistance of an armature is a perfectly simple matter when the machine is at rest. When it is running the insulation is sometimes under very heavy voltage stress, experiences severe mechanical strains, and is affected by high temperature and atmospheric conditions. E. O. Schweitzer's paper in the current issue gives a very ingenious and useful method of keeping the armature insulation of a high-voltage generator always under observation. The connections and method of using the apparatus are excellently shown in his paper. The principal difficulty which was encountered was due to the effect of static charge in giving false readings on the megger. This difficulty was overcome by connecting the megger to the circuit before the armature was energized, thus sufficiently dissipating the static charge to avoid trouble.

Preliminary tests showed that in armature resistance there was a steady decrease in the megohms indicated as the voltage rose. With the insulation very dry and in first-class condition this decrease was small, while if the initial value had been lowered by the absorption of moisture the change with rise of voltage was unpleasantly rapid. The experiments went far enough to show that the scheme would develop important information regarding the condition of insulation resistance with very little trouble, and it deserves application on a wider scale. We may go further and say that insulation measurements in general should be made as far as practicable under working conditions and with working voltages, with the limitation that in some cases there seems no way of avoiding the use of direct current for the insulation test on account of the capacity effects. Megohm resistances tested under a potential strain of only a few hundred volts cannot be considered a fair measure of what the insulation will do when worked at 20,000 volts under practical conditions of mechanical stress and temperature. There needs to be a considerable development of apparatus for measurements at high pressure, for every year the working voltage on cables and machinery tends steadily upward, so that the testing methods of fifteen or twenty years ago are obsolete. We are glad Mr. Schweitzer has taken up the matter seriously with so good a prospect of solving a difficult problem with practical success.

What Good Lighting Means to Industry

UNDER the stress of war conditions, with many plants operating in three shifts, still greater emphasis must be laid on the effect of illumination upon working efficiency. It is not only necessary to improve lighting conditions temporarily, but to bring them to a point of effectiveness where the night shifts will turn out as much and as good work as can normally be expected from a day shift. Professor Clewell's notes on industrial lighting summarize excellently well the conditions which have been brought about within recent years. The main source of improvement lies in the very low cost of luminous flux with present lamps and at present rates. The change in the specific consumption of lamps in ordinary use from 3.5 watts per candle to 1 watt, with the simultaneous downward tendency in prices of energy, has made light one of the cheapest of useful commodities. From a purely practical standpoint, too, the work of the illuminating engineers and the manufacturers in getting modern lamps down to a businesslike basis as producers of illumination has been very effective. The production of the new lamps of fairly large power and great intrinsic brilliancy has compelled many changes of the methods of installation. These have come about sometimes rather tardily, but there is no excuse at the present moment for poor illuminating appliances either on the ground of availability or of cost.

The beginning of improvement came with the metallic-filament lamp and has been continued by the introduction of the big gas-filled units which bring the cost of light to an extremely low figure. For certain purposes arc and mercury-vapor lamps still find a useful place, the first chiefly in very large areas, the second especially in metal-working establishments where the particular color characteristics of the light are sometimes of great service in facilitating the detection of blemishes which might otherwise escape notice. But the backbone of industrial lighting at the present time is the gas-filled lamp of power between those common with the old tungsten lamps and those found in the arc. As Professor Clewell points out, there has been a certain amount of standardization in the matter of fixtures, but this has not yet gone far enough to enable a fixed system to be

laid out for a factory building irrespective of the uses to which it is to be put. A good many failures have resulted from the notion that standardization has really been accomplished. What can be said, however, is that the two or three general methods in use are so familiar and effective that wide departures from ordinary practice do not have to be made, although the lighting has to be laid out skillfully to fit the individual case. From a purely practical standpoint the manufacturer has learned that good lighting means more and better output, as we have many times pointed out—enough more and enough better to pay handsomely for the investment in light.

Maximum-Demand Meters

A STUDY of the common types of maximum-demand meters and of the possible instrumental errors which their use may show brings out many interesting points. Many contracts being based on the maximum demand, usually over a specified length of time, the demand-reading meter has a useful and legitimate field. In certain classes of installations where the time of the maximum demand is approximately known the relation of this demand to station economics becomes very simple, and the customary instruments are very well suited to the work. By general average one can take account even of the rapidly intermittent loads with reasonable fairness, although the results must necessarily contain a large factor of experience in the relation between instrument readings and the resulting effect on the station. In fact, once the characteristics of a consumer's load are known, suitable applications can be found for the types of maximum-demand instrument now on the market. The point which we wish to emphasize, however, is that unless the real nature of the fluctuations in any given case is known from observation or experience, the demand instrument is liable to be somewhat misleading. The upshot of the matter is that in the case, for instance, of taking on a factory load of an unfamiliar kind nothing except a curve-drawing instrument with charts taken over an adequate period can give a really accurate idea of the load characteristics in their relation to station performance. Whatever instruments are at hand for use, when conditions permit the curve-drawing instrument should be the court of last resort in the study of new conditions and the interpretation of records otherwise obtained.

Help the Liberty Loan

ONLY by selling securities regularly can the electric central station provide the enormous capital needed for expansion; but to-day it, with other elements in the industry, is in the position, not of selling, but of buying. With other factors in the industry, it is investment buyer of government bonds; it is banker for employees who are pledging savings to the "Liberty Loan"; it is publicity agent for Uncle Sam, who is raising the strong sinews of war. The industry is giving public service in a new form by helping along the sentiment that leads every one to do his "bit." Concrete advice to electrical companies by F. A. Vanderlip, president National City Bank of New York, published in the ELECTRICAL WORLD of May 26, is in effect: Subscribe on your own account; make it easy for employees to subscribe; send out with bills and notices a Liberty Loan inclosure; grant free advertising facilities to the Liberty Loan local committees. It cannot be expected that electrical companies will do as much to help as the banking agencies which make a business of placing securities with investors, for they lack the necessary training; it is expected that they will do what they can, be it little or much, without loss of time. They cannot turn a plant or a generator into the government treasury in payment for bonds, but they can show employees the meaning of subscription; they can lend the aid of their organizations and resources; they can in a great many instances invest according to their individual means. The opportunity to render public service, which after all is their real business, stands before us merely clothed in new garb. Shall we do our part? It is the largest duty and privilege, the greatest public policy problem which the industry ever faced. Wisdom and patriotism point the way clearly.

The Coming Issues

IN THIS and past issues we have suggested how increased expenses due to the high cost of materials and labor can be offset by interconnecting favorably situated systems, by the use of low-grade fuels, by the installation of inexpensive forms of transmission lines, etc. The next issue will contain the results of an analysis which may be applied quite generally for determining how distribution transformers may be installed with respect to each other so that the voltage drops and consequently the line loss shall be kept within permissible limits and so that the transformers shall not be overloaded. Curves are presented to enable a study of this kind to be made with the least calculation. An article which deals with the mutual inductance of parallel reactors and the forces exerted between them should also be of interest, as these adjuncts to electric-service equipment are coming to be used more and more where disturbances must be confined to the sections in which they originate. Applications of the principles discussed are taken up in specific examples, and comparisons are given of the results obtained by formulas and actual test data. The third installment of Professor Clewell's articles on industrial lighting is especially significant, as it shows what an important factor adequate illumination is in preventing accidents. This article should be of interest to central station salesmen seeking new lighting contracts and to factory managers who seek to reduce accidents. Among other interesting articles in the coming issue will be short accounts of schemes used by different operating companies for improving plant economy and bettering service. A timely article will be published on the relation between coal cost and power rates in a small central station plant. In the fourth issue of June there will be discussed the value of grain elevators as central station loads. This article will contain data of value to power salesmen, consulting engineers and contractors.

Oil Engines as a Relief Against Coal Prices

Advisability of Considering Them as a Means to Reduce Standby Expenses—Characteristics of Various Types of Internal Combustion Engines and Their Different Fields of Application

BY A. A. POTTER

Dean of the Engineering Division and Professor of Mechanical Engineering, Kansas State Agricultural College, Manhattan, Kan.

INCREASED prices of coal, the difficulty of securing deliveries and the high cost of labor have made many operating companies seek new methods of reducing the cost of generating electricity. In large plants these new conditions are being met by using stokers that can burn low grades of coal and by operating boilers and prime movers that are very efficient. Smaller plants, however, which do not have loads that will justify the expense of installing such equipment must look elsewhere for relief. While many such companies may improve their plant economy by removing the sources of waste which have heretofore been left unhindered, many of these companies can consider the use of internal-combustion engines as a means of reducing labor, fuel and standby expenses. This is especially true at this time, as there is every likelihood that the price of coal will go higher.

Oil engines using various fuels are beginning to play a very important rôle in the Southwest, where large quantities of oil are available at a cost which compares favorably with the cost of coal in the same territory. Several recent installations of oil engines using the heavier fuels are even competing with steam prime movers in power plants rated at 200 kw. to 1000 kw. The fact that internal-combustion engines are equally economical in all sizes makes this type of prime mover especially advantageous for small power plants, where several oil engines can be made to carry the load, with the consequent high load factor of each unit and the increased reliability of service. The oil engine is also used to some extent as an auxiliary for small hydroelectric power plants and as an emergency peak-load unit in steam-electric power plants.

Petroleum distillates are used chiefly in liquid-fuel engines, although alcohol, tar, tar oil, shale oil and phenoloid (liquid fuel from blast furnaces) are also employed to some extent. The first successful internal-combustion engines using liquid fuels were gasoline engines, as gasoline is the lightest of all commercial hydrocarbons and is easily vaporized at ordinary atmospheric temperatures. Gasoline engines consume one-eighth to one-tenth of a gallon of gasoline per brake-hp.-hr., this being equivalent to a heat consumption of 11,000 to 16,000 B.t.u. per brake-hp.-hr. Owing to the development of light-weight high-speed oil engines for automobile and for aeroplane use, there has been such an increase in the demand for gasoline that the price of this distillate will remain high in spite of the new and more efficient processes developed for the extraction of gasoline from crude petroleum and for the liquefaction of natural gas. Nevertheless gasoline will remain the most important fuel for small stationary and portable engines for many years to come because of the ease of starting and the greater reliability of engines driven by this fuel compared with other internal-combustion engines.

Kerosene, which can be secured in greater quantities than gasoline and which has a rather limited market, ranks next to gasoline among the products of crude petroleum for use in oil engines. This fuel is more difficult to vaporize at ordinary temperatures and presents more serious operating problems, however, than gasoline. Engines operating with kerosene must be started with gasoline, or must be provided with some form of hot-plate vaporizer which will prepare the kerosene for combustion. As a fuel, kerosene is used at the present time in stationary engines of 5-hp. to 75-hp. rating. The fuel consumption of kerosene en-

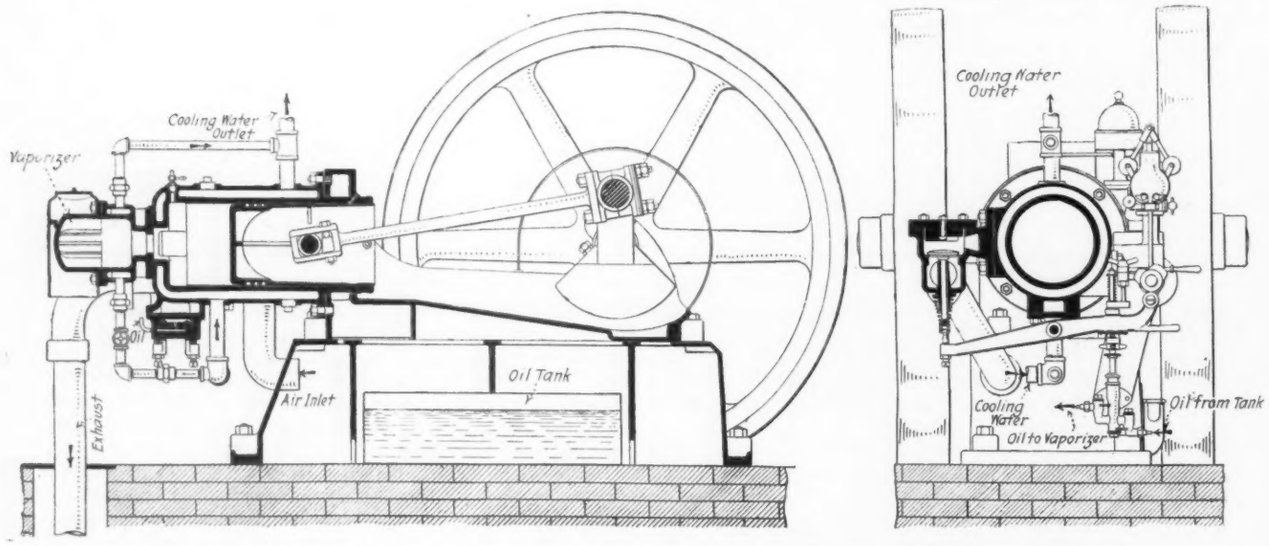


FIG. 1—LONGITUDINAL AND TRANSVERSE SECTIONS OF A LOW-PRESSURE HOT-BULB OIL ENGINE

gines is about one-tenth of a gallon per brake-hp.-hr., or 14,000 to 18,000 B.t.u. per brake-hp.-hr.

In general liquid fuels even as heavy as 35 deg. Baumé, which corresponds to a specific gravity of about 0.849, can be used in engines differing only slightly from ordinary gasoline engines. Experience demonstrates that the heavier the fuel the more difficult it is

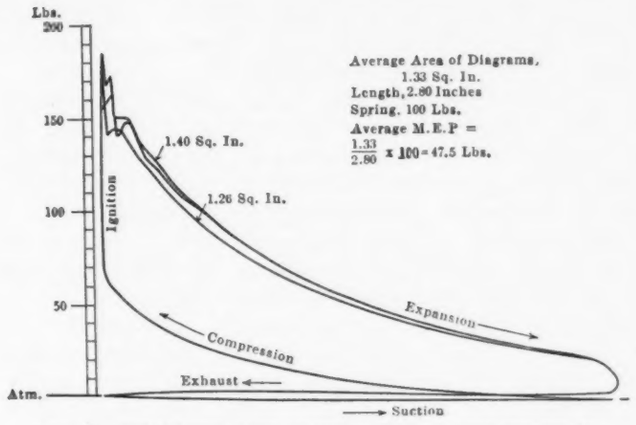


FIG. 2—INDICATOR CARD TAKEN WITH A LOW-PRESSURE HOT-BULB OIL ENGINE

to start the engine, and the more frequently valves and pistons will have to be cleaned.

Oil engines which employ electric ignition cannot operate satisfactorily on petroleum fuels heavier than about 30 deg. Baumé. Several of the so-called "hot-bulb" types of oil engines (Fig. 1) are found to give fairly satisfactory service with petroleum oils as heavy as 28 deg. Baumé. For the use of still heavier oils either the hot-bulb type engines must be designed to operate as semi-Diesel engines (Fig. 3) at compression pressures of about 300 lb. per square inch (21.09 kg. per sq. cm.) or some form of oil engine operating on the Diesel internal-combustion engine cycle must be used (Fig. 4).

Alcohol has received considerable attention in this country and in Europe for internal-combustion engines. This fuel is very nearly inexhaustible in quantity and is favored in that alcohol extends the markets for fuel supply beyond the control of certain monopolies. Investigations with alcohol as fuel indicate that engines designed for that fuel and operated at compression pressures of about 180 lb. per square inch (12.65 kg. per sq. cm.) will develop as much power per gallon of fuel as engines of the same size and speed designed for and operated with gasoline as fuel. When used as a fuel in ordinary gasoline engines and with the compression pressures ordinarily allowed for gasoline, however, alcohol will show a much poorer economy than gasoline or kerosene. Furthermore, the high price of alcohol as compared with petroleum fuels puts the alcohol engine out of competition with oil engines, at least for the present.

Oil engines operate either on the Otto or on the Diesel internal-combustion engine cycles.* Engines operating on the Otto cycle are cheaper to build, require less supervision and are the standard type for gas and oil engines in this country. Diesel types of engines give better fuel economy and are capable of operating with the very heaviest petroleum fuels as well as with tar oil and with gas-house tar. Under ordinary conditions Diesel engines will have a thermal efficiency of about 30 per cent, while oil engines operating on the Otto cycle will usually convert less than 20 per cent of the total heat contained in the fuel into useful energy.

The first cost of Diesel engines is from two to four times greater than that of Otto engines of the same size. In this country the availability of enormous fuel resources has prevented a demand for an engine which has a very high first cost. The comparative demands for Diesel engines in the United States and in Europe are evident from the fact that only about 100,000 hp. is developed by Diesel engines in this country as compared with more than 1,500,000 hp. in Europe before the war. The ratio of labor cost to fuel cost is responsible for this difference, but the use of Diesel engines is greatly increasing in the United States, and especially in the Southwest. The oil fields recently discovered in the southwestern parts of this country and in the adjacent parts of Mexico should still further increase the demand for heavy oil engines.

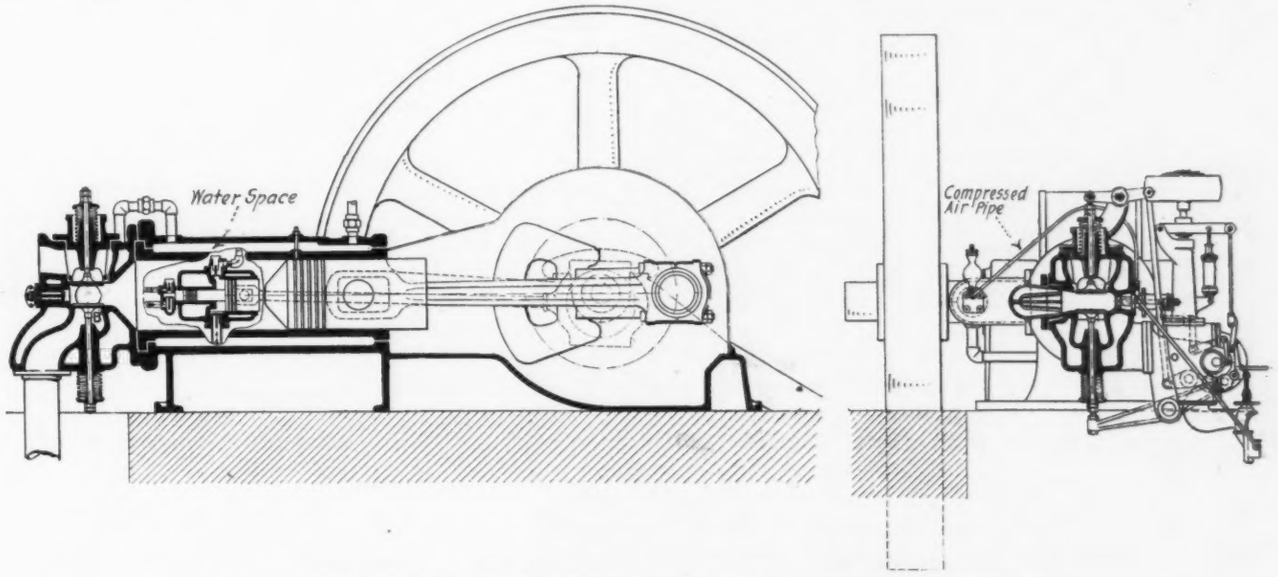


FIG. 3—LONGITUDINAL AND TRANSVERSE SECTIONS OF A SEMI-DIESEL OIL ENGINE

The Otto as well as the Diesel cycle comprises five

*The term cycle is applied to a series of events which are essential for the transformation of the heat energy of a fuel into work.

events: Suction, compression, ignition, expansion and exhaust. Engines of both types can be designed either as four-stroke-cycle engines or as two-stroke-cycle engines. Engines operating on either the Otto or the Diesel cycle have poor starting torque and must operate at a high load factor. The chief differences between the Otto and the Diesel cycle are as follows:

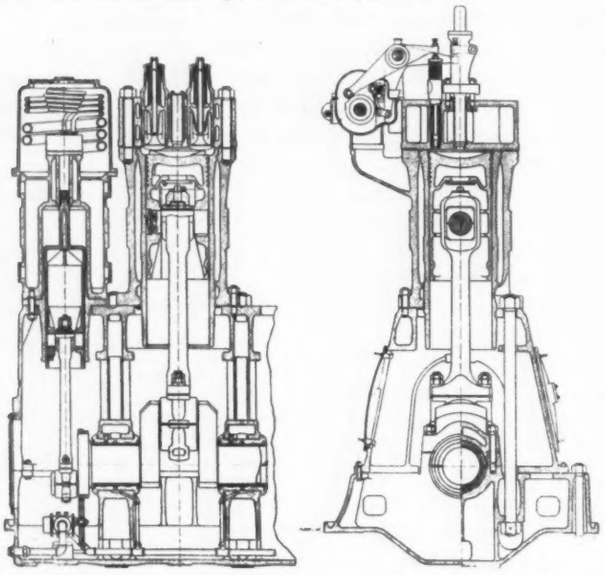


FIG. 4—SECTIONAL VIEW OF A DIESEL OIL ENGINE

In order to carry out the Otto internal-combustion engine cycle, air is mixed with the fuel in definite proportions and the combustible mixture is subjected to the process of compression. Thermodynamic considerations indicate that the thermal efficiency of an engine operating on this cycle depends upon the amount of compression before ignition. Danger from pre-ignition of this combustible mixture limits the practical compression pressures for petroleum fuels to less than 100 lb. per square inch (7.03 kg. per sq. cm.).

In the Diesel-engine cycle only air is admitted to the cylinder during the suction stroke, so that compression pressures as high as desired can be permitted without danger of pre-ignition. The compression pressures used with the Diesel engines vary from 450 lb. to 500 lb. per square inch (31.6 to 35.1 kg. per sq. cm.). The higher compression-pressure limit in this case is not dependent upon the composition of the mixture within the cylinder but upon construction difficulties. At the end of the compression stroke of the Diesel-engine piston oil fuel is injected into the cylinder by air from a special air compressor. The oil enters the cylinder in the form of a fine spray, mixes with the highly compressed air, which is at a temperature of about 1000 deg. Fahr. (537 deg. C.), and burns at nearly constant pressure. The duration of the oil injection is governed by the load upon the engine, and this period of oil injection, as well as the compression pressure of the air before ignition, influences the thermal efficiency of the Diesel engine.

The combustion of the mixture in the Otto cycle is produced at a practically constant volume. Compared with gunpowder, the explosive mixture in the Otto gas-engine cylinder has a much slower rate of flame propagation, and the maximum pressure at the end of combustion will rarely be greater than four times the compression pressure before ignition.

The relatively high cost of Diesel engines is due partly to the fact that the maximum pressures in this type must be produced by compression, and this requires great accuracy of piston fits and the most careful alignment of parts. The fuel in the Otto types is prepared in a carburetor or in a vaporizer outside of the engine cylinder. In the Diesel engine the fuel preparation and injection process takes only about 0.04 second under ordinary loads, so that design of the fuel valve becomes a most difficult and important problem. Furthermore, the air compressor used with a Diesel engine must not only supply air for starting but must compress air to a pressure of about 1000 lb. per square inch (70.3 kg. per sq. cm.) to be used for injecting the oil fuel into the cylinder. All these factors account for the necessary high cost of Diesel engines.

In large sizes of Diesel engines the increased cost is compensated for by the higher fuel economy and by the ability of this type to operate on any liquid fuel without leaving any appreciable residue. This form of engine is now operating successfully in Texas, in California and in other States with the Western oils, which have an asphalt base and are much poorer than the Eastern oils. According to several tests on record, the fuel economy of Diesel engines is about 0.45 lb. of fuel oil per brake-hp.-hr.

Medium-compression types, often called the semi-Diesel engines (Fig. 3), also have an important field in the utilization of the heavier oils. This type of engine is being built by several companies in this country in sizes ranging from 75 hp. to 400 hp. Like the Diesel types (Fig. 4), these engines compress only air, but have a lower pressure range, depending partly on hot surfaces to ignite the charge. During the earlier developments of the Diesel engine in this country the semi-Diesel types played a prominent rôle in the utilization of the heavier liquid fuels. The new designs of the Diesel engines limit the field of the semi-Diesel types, the somewhat lower cost of the latter being greatly offset by the greater economy of the Diesel types. The heat consumption of semi-Diesel types will vary from 8700 to 13,000 B.t.u. per brake-hp.-hr., while the heat consumption of a Diesel engine will range from 7000 to 9500 B.t.u. per brake-hp.-hr.

Data based on engines operating at full load showing approximate comparative fuel costs per brake-horsepower-hour for various fuels and various types of engines are given below. It should, however, be remembered that the economy of an oil engine is greatly decreased at light loads and is best when the greatest amount of charge at its maximum density is admitted to the engine cylinder.

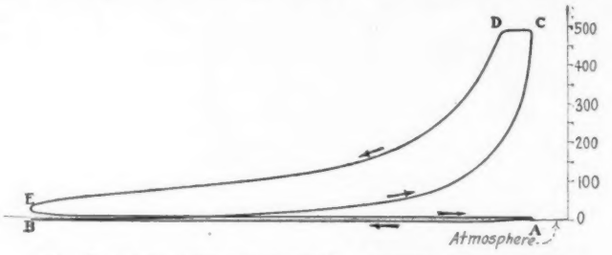


FIG. 5—INDICATOR CARD FROM A DIESEL OIL ENGINE

Fuel	Cost in Cents per Gal.	Cost in Cents per Liter	Cost per Brake-Hp.-Hr. (Cents)
Gasoline	20	5.3	1.5 to 2.5
Kerosene	6	1.59	0.6 to 1.0
Fuel oil	2	0.53	0.11* to 0.15*
Fuel oil	2	0.53	0.15† to 0.20†

*Using Diesel engine. †Using semi-Diesel engine.

The approximate first costs, in normal times, of various types of oil engines are as follows:

Type of Engine and Rating	Cost per Hp.
Diesel (1000-hp. and 75-hp.)	$50 and $85
Semi-Diesel (60-hp. and 400-hp.)	50 and 70
Light-fuel type up to 75-hp. with throttling governor	35
Gasoline type with hit-and-miss governor	15 to 30

Summarizing the status of the oil engine briefly: Engines operating on the Otto cycle are more practical for gasoline, kerosene, alcohol and petroleum fuels, even as heavy as 30 deg. Baumé. For the heavy petroleum fuels and for other low-grade liquid fuels either the Diesel or the semi-Diesel types should be selected. In general the oil engine is bound to be a very important factor in the future of power development in the United States.

Testing Insulation of Generators in Motion

Importance of Studying State of Insulation Under Operating Conditions—Features of a Test Method Involving Use of Non-Inductively Wound Exploring Windings on End Turns of Apparatus

BY E. O. SCHWEITZER
Chief Testing Engineer, Commonwealth Edison Company

BREAKDOWN of a generator is not a pleasant prospect under any conditions, but it is particularly to be avoided when the size of the units used is very large, when the amount of reserve equipment is small, or when all equipment is being utilized, as may happen during peak loads. Under such conditions the breakdown of one machine may mean the loss of considerable revenue and possibly some valuable industrial consumers, in addition to the inconvenience of getting the equipment in operating condition once more.

At this time, when every bit of available power should be made ready for manufacturing purposes, it is particularly important that such trouble be prevented. Since insulation is probably the most vulnerable part of generators, it is necessary that its condition be known at all times. Of course the resistance of the insulation can be easily measured when a generator is at rest, but this value is vastly different from that when the generator is subjected to service stresses of voltage, current, temperature and atmospheric conditions. Furthermore, it is the condition while the machine is running that is important.

NATURE OF INVESTIGATION

To avoid the difficulties of measurement heretofore experienced in determining the condition of insulation while a generator is in motion the following investigation was conducted under the supervision of the writer: A representation of a three-phase alternator was devised by connecting the high-voltage sides of three 110/11,000-volt potential transformers in a star. In series with each potential transformer was connected an armature coil such as is used in a large 9000-volt, 25-cycle turbo-generator. These coils represent the last coil on each phase of the generator winding. The portion of each armature coil which in actual service would be embedded in the generator core was wrapped with tinfoil, and the tinfoil on all of these coils was tied together and grounded. From the copper of each armature coil a tap was taken off to each of three Y-connected potential transformers which represented those used in practice for metering purposes. The neutral point of these transformers was connected with the generator neutral, which in turn was connected to ground through a switch. With this switch closed the generator neutral, generator core and generator potential-transformer neutral are brought to the same potential.

On that part of the armature coil which corresponds to the end turn was placed a non-inductive winding of No. 19 bare copper wire. The non-inductive windings, or exploring coils, were placed on the end turns, as these constitute the part of a generator winding which is subjected to the greatest destructive action of vibration, condensation, windage, electrostatic strains and, in the case of short circuit, mechanical strains. The three exploring windings were connected in series so that the entire winding formed a closed loop, an insulated lead being connected to it and brought out to a terminal. The other terminal of the circuit was brought out from the generator potential-transformer neutral. Across these two terminals a high voltage direct-current supply was connected. The electric circuit thus formed is as follows: From the direct-current source to the winding on the end turns, through the insulation to the copper of the coils, through the phase leads to the potential-transformer windings, and from the neutral point of these transformers to the direct-current source. The

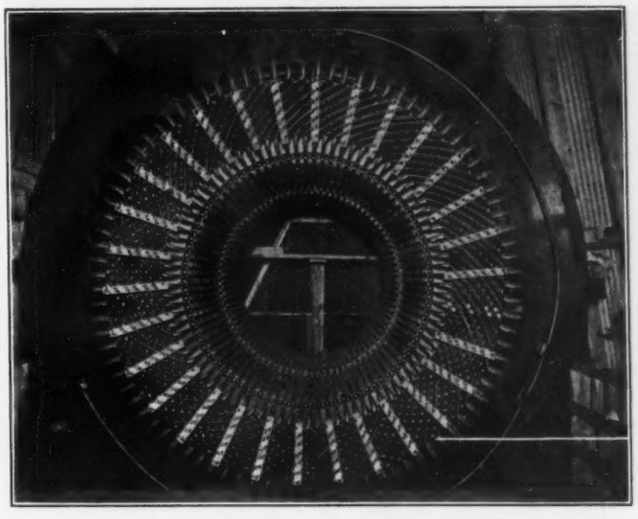


FIG. 1—GENERATOR WITH END-COIL EXPLORING WINDINGS

The white line indicates where one terminal of the megger is applied when testing the resistance of insulation on the armature coils.

direct-current supply used in this case was a 1000-volt megger. The instrument is calibrated to indicate resistance directly in megohms. The potential transformers which were used to represent the generator winding were excited from a three-phase, 60-cycle supply which was arranged to give 5000 volts to 15,000 volts delta pressure on the generator.

RESULTS OF TESTS WITH EXPLORING WINDINGS ON END TURNS OF 9000-VOLT GENERATOR WINDING

Delta Pressure Volts	Insulation Resistance (in Megohms) Between Potential-Transformer Neutral and Exploring Winding with		Insulation Resistance (in Megohms) Between Potential-Transformer Neutral and Ground. Generator Neutral Open from Ground
	Voltage On	Voltage Off	
15,000	550	800	800
14,000	560	800	800
13,000	580	800	800
12,000	600	800	800
11,000	620	800	800
10,000	630	800	790
9,000	630	800	800
8,000	680	800	800
7,000	710	800	800
6,000	730	800	790

With the higher pressures of 9000 volts and up, the formation of static electricity on the copper exploring windings introduced considerable difficulty when the armature coils were energized and the megger was connected to the circuit. Although the static energy was small, the megger acted as an electrostatic voltmeter and showed a deflection of the indicator. To eliminate this trouble several schemes were tried whereby it was sought to eliminate the effect rather than the cause. A spark gap was shunted across the iron-core reactance coils in series with the megger, whereby a path to ground was afforded for the high-frequency static charges. Apparently the frequency was so high, however, that the energy passed over the surface of the reactance coil instead of through it, and thus the scheme was a failure. A condenser shunted across the megger eliminated the static through it, but when the megger was operated it measured the insulation resistance of the condenser in parallel with the insulation resistance of the armature windings.

After several trials of the nature mentioned it was

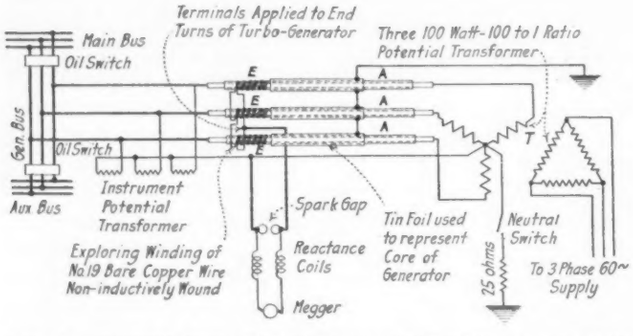


FIG. 2—CONNECTIONS EMPLOYED IN MEASURING INSULATION RESISTANCE OF GENERATOR IN SERVICE

found that by connecting the megger to the circuit first and then energizing the armature the disturbance in the megger reading due to static electricity was eliminated. Apparently the energy of the static charge was so small that upon shunting it through the megger before closing the circuit the charge had no chance to build up.

With the insulation on the armature coil very dry, tests were made with different pressures (6000 volts to 15,000 volts) between phases. Under these conditions the insulation resistance decreased with an increase in voltage, but the decrease was small. With 2000 megohms insulation resistance the resistance decreased to about 1850 or 1900 megohms with 15,000 volts between phases. The insulation on the coils under the exploring winding was then moistened until the insulation resistance was reduced to 800 megohms with no pressure on the coils. A series of measurements was made with the coils in this condition, and it was found that the insulation resistance was lower at 15,000 volts by 250 megohms than it was with no voltage applied. The values obtained in this test were duplicated under the same conditions thirty minutes later. From the accompanying curve, which was drawn to show the relation between insulation resistance and delta voltage, it may be seen that the insulation resistance decreases following a straight line from 6000 volts upward.

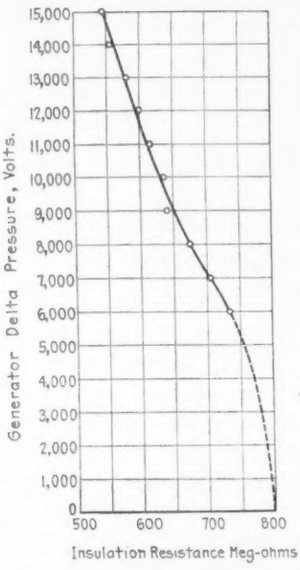


FIG. 3—EFFECT OF VOLTAGE ON INSULATION RESISTANCE

To give a measure of the static formation on the exploring winding a spark gap with a setting of about 1/32 in. (0.8 mm.) was shunted across the exploring winding and the potential transformer neutral. It was found that the lower the insulation resistance the greater and more violent the static discharge became; that is, with 15,000 volts between phases and the insulation at 550 megohms the static charge was greater than with 15,000 volts applied and the insulation on the coils dry with a resistance of 2000 megohms. From this observation it may be seen that the static discharge from a winding such as described would in itself be a reasonably accurate measure of the insulation resistance of a generator winding.

The measurements proposed in this scheme should preferably be made with the neutral closed to ground to afford maximum protection for the operator and to prevent disturbance due to a possible difference of potential existing between the generator neutral and ground. As shown in the sketch, the leads from the generator potential-transformer neutral to the spark gap and the two elements of the gap are very heavy in order to insure a large heat-dissipating capacity. These leads are fused with low-rated fuses so that in the event of a breakdown of the insulation under the exploring winding the dynamic energy would cross the gap to ground, which would open the fuses and clear the megger circuit.

In case of a weak point occurring in the insulation within the slot, the measurement path to the fault is not the leakage surface over the coil to the fault, but rather from the exploring winding to the core and from the core to the fault in the slot. Hence a fault occurring within the slot insulation would also be measurable with the proposed scheme.

UTILIZING COAL-MINE WASTE

Test Plant for the Burning of Powdered Coal Built by Pacific Coast Company—Results of Test

BY HENRY HULL

Prompted by the large amount of unmarketable fine coal which is piled up at numerous nearby coal mines, the Puget Sound Traction, Light & Power Company has investigated the practicability of burning powdered coal. This coal is a form of lignite particularly adapted to use in the powdered form owing to the high volatile constituent and the very high fusing point of the ash. To prepare this coal for burning it must first be thoroughly dried and the moisture content reduced to approximately 1 per cent before it can be properly pulverized. It must then be ground until approximately 85 per cent will pass through a 200-mesh screen and 95 per cent through a 100-mesh screen if the best results are to be obtained. It should then be fed directly to the furnace, or if transportation or storage is necessary it should be kept air-tight so far as possible to prevent absorption of moisture.

TEST OF 300-HP. B. & W. BOILER BURNING POWDERED COAL

Coal Analysis

Moisture	Volatile	Fixed Carbon	Ash	Sulphur	B.t.u.
5.4	37.2	47	10.4	0.56	11,760

Ash Analysis

SiO_2	44	CaO	7.75
FeO	10.45	MgO	2.40
Al_2O_3	32.88		

Screen Test of Coal

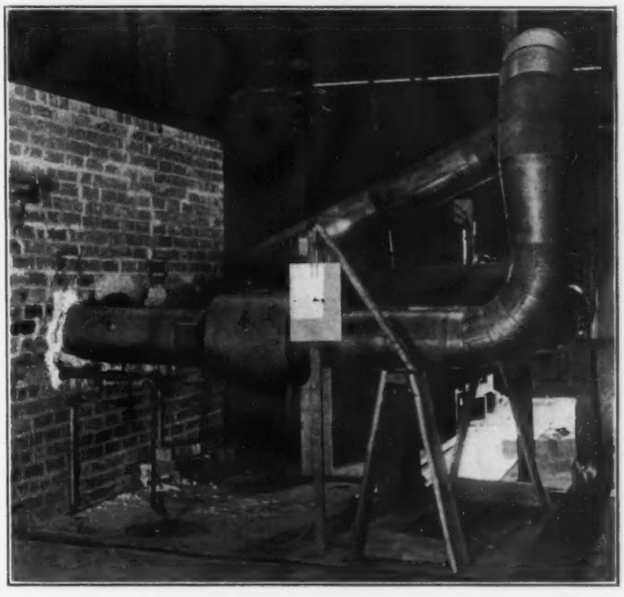
	Per Cent of Coal Passing
On 100 mesh	5.8
Through 100 on 200	34.6
Through 200	59.6

Duration of test (hours)	12.8
Average boiler-hp. developed	357
Total water evaporated (lb.)	143,231
Average temperature of feed water (deg. Fahr.)	185
Average steam pressure (lb. gage)	106.5
Average temperature of steam (deg. Fahr.)	399
Average flue-gas temperature (deg. Fahr.)	528
Average draft at uptake (in. water)	0.17
Average flue-gas analysis in per cent:	
CO_2	17
Oxygen	2
CO	0
Total coal burned (lb.)	18,389
Actual evaporation per lb. of coal (lb.)	7.8
Equivalent evaporation from and at 212 deg. Fahr. (lb.)	8.6
Boiler efficiency (per cent)	71

The coal which has been investigated by the Puget Sound company is dried and pulverized by the Pacific Coast Coal Company at its briquetting plant, near Renton, which is equipped with a Raymond pulverizing plant. It is then loaded in a box car having a metal-lined hopper. The car is spotted at the steam plant over a chute which is connected to the car by a flexible hose. The chute feeds a small metal-housed conveyor which elevates and dumps the coal into a bunker adjoining the power plant. From the bottom of this the fuel is fed by means of two motor-driven screws into a 3-in. (7.62-cm.) supply pipe, through which it is then blown to the front of the furnace. At this point the fuel is discharged into the side of an injector consisting of a 16-in. (38.1-cm.) drum surrounding a nozzle on the end of a 10-in. (25.4-cm.) air-supply pipe. Dampers are provided in the drum and air pipe to regulate the amount of air supplied to the combustion chamber. In starting operation the coal dust is allowed to drop on an oil flame, although any small fire built under the fuel discharge pipe would have the same effect. An extended Dutch oven with a broad arch is used to assist ignition as considerable combustion space is required to secure satisfactory results, a parabolic shape being most desirable. Fire cannot travel back into the fuel supply pipe as long as the rate of air supply is greater than that of fuel propagation.

A record of a 12.8-hour test on the equipment is given herewith. The duration of the test was limited by the facilities for storage and handling of the fuel. The coal was weighed in the car as delivered to the plant and the net weight determined by a subsequent weighing of the car after unloading. The test was run until all coal was consumed. The water was measured by a Venturi water meter installed in an individual feed line to the boiler, and all instruments were checked for accuracy before starting.

During the test it was noted that the boiler could be forced to 200 per cent of rating without any apparent damage to brick setting or tubes. The stack was perfectly clear under these conditions and there was no fusing of the ash. About one-third of the ash was found deposited in the second and third passes of the boiler, none whatever being found to have collected on the tubes.



ARRANGEMENT FOR BURNING POWDERED COAL UNDER A 300-HP. BOILER FORMERLY FIRED WITH OIL

The results of the experiment tend to refute most of the adverse criticism of this method of burning coal. There was no formation of slag in the furnace or on the tubes, there was no shower of cinders and ashes emitted from the smokestack, and there was no damage done the boiler from heavy overload under these conditions.

From the experiments in burning these various fuels it was found that—assuming pea coal at $1.60 per gross ton ($1.76 per t.)—the prices which could be paid for other fuels on the basis of equal heating values are as follows: Pea coal on chain grates, $1.60 per gross ton, delivered; fuel oil, 56 cents per barrel, delivered, and powdered coal, $2.20 per gross ton, delivered.

The temporary plant was designed by E. B. Powell of the Stone & Webster Engineering Corporation of Boston, Mass.

War a Stimulating Influence

Careful Direction and Distribution of Our Great Resources Is Necessary, Says A. L. Salt, Vice-President Western Electric Company— Combination Should Be Permitted

Upon the conclusion of peace I expect that this government will follow a humanitarian course, directing and distributing our great resources so that the whole world, sorely needing materials and commodities of every nature, will be served here on equitable terms.—*A. L. Salt.*

AT THE request of the ELECTRICAL WORLD, A. L. Salt, vice-president and general purchasing agent of the Western Electric Company, has given the following statement of his views concerning raw material and commodity prices and conditions affecting production:

"When the first move toward peace came from Germany toward the close of 1916 I felt that the end of the war was definitely forecast by that action, and that however long a period might be required to settle the details of a peace agreement a gradual liquidation in material and commodity prices was inevitable. Since that time, of course, the complexion of the war has been changed by the renewal of the submarine campaign and the consequent entrance of the tremendous industrial momentum of the United States in the conflict against the discredited government of Germany.

SHARP FLUCTUATIONS LIKELY

"While the war lasts and for some time thereafter it is my opinion that there will be sharp fluctuations in the prices of various commodities, due to scarcity or abnormal demands in one direction or another. If prices take the natural course dictated by the law of supply and demand, it appears to be likely that for some time the general average price of all commodities combined will be high.

"Just now the various sources of supply in this country are filled with orders to the limit of their capacity. We have had to work along the safest and most conservative lines in placing orders ahead, and it is not prudent to fail to protect requirements to at least a reasonable extent in advance. The industries of the country are still practically sold ahead through the present year. Consumers have had to go into the market freely, not because they felt that prices were inviting at the current level, but because it was necessary for them to have a place on the delivery schedule of all large industries. In the iron and steel industry, for instance, if no new business should be taken, I believe that the orders in hand could not be filled in less than eighteen months, so enormous and unprecedented is the demand.

STIMULATES EVERY LINE OF TRADE

"Of course, the entrance of our country into the war is a large factor in stimulating nearly every line of trade. There is scarcely a commodity of which I have knowledge where the government will not have to appear as a buyer. That means that it will have to have preference in delivery and preference in price. It means, furthermore, that all industries will have to be coordinated so as to give the government the best service and materials at the lowest practicable prices. Smaller consumers will have to take what is left after government requirements are met in full.

"Something in the way of a well-defined government and business policy governing these matters is essential and it is being worked out carefully. It is to be hoped that under this policy that very large part of the world which is now to so great an extent dependent upon our country will be taken care of economically and expeditiously.

TO RESTORE WAR'S MATERIAL WASTE

"Yet fair provision for our allies is only a part of the great program which it appears to me the government should undertake in following the irreproachable motives which carried it into the war. Upon the conclusion of peace I expect that this government will follow a humanitarian course, directing and distributing our great resources so that the whole world, sorely needing materials and commodities of every nature, will be served here on equitable terms. This policy will lead us, I believe, to be of service, not only to our present allies but also to the German nation freed from slavery to the menacing Prussian militarism.

"In other words, our resources will be co-ordinated with those of other nations and the entire world will be working in close co-operation to restore with all possible speed the terrible material ravages of the war.

"It is a time of greatest perplexity to the buyer of materials. On the one hand, he realizes that whatever he buys greatly increases his capital investment. On the other hand, he faces the necessity of going ahead and doing business because orders were never larger or more insistent and consumers were never more in want of supplies. The problem is to keep supplied with materials under conditions which mean for a given amount of materials twice the investment that would have been required a few years ago. The company which kept $1,000,000 of stock on hand three years ago now pays $2,000,000 for the same stock. It not only takes more money but it means a permanent increase in cost, and it involves also the chance of depreciation if prices should react materially.

COMBINATION SHOULD BE PERMITTED

"No company wants to expand its business unless it can see some reasonable return on its capital invested. High prices, slow delivery, embargo, car shortages, etc., are influencing to a great extent the industrial situation of the future. On the other hand, government expenditures in this country alone will reach billions of dollars, and to these must be added the equally large expenditures of the allied European countries. It is the most insistent buying which the world has ever seen.

"Supply and demand are so inexorable in normal operation that it seems to me that now, of all times, the producers of raw materials and the manufacturers of finished products should by combining be permitted to establish fair maximum prices which would yield only a fair return on their invested capital."

Modern Lamps and Industrial Applications

Solution of Lighting Problems Rests to Great Extent on Use of New Types of Lamps —Progress in Industrial Lighting Depends on Emphasizing Availability of Considerable Light at Fair Cost

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania.

SUMMARY.—This article treats of the importance of modern lamps in the field of industrial lighting. Representative modern types of electric lamps are illustrated, and throughout the text references are made to the field of usefulness of the various lamps now on the market. With the aid of typical diagrams, four general schemes—known as local lighting, a combination of local and general lighting, localized general lighting and general lighting—are compared and their relative merits discussed. The remarkable developments in factory lighting practice in the recent past, and the future of this work, depend so largely on the lamps available that these features become of unusual importance.

FIVE broad factors stand out as the basis for the marked improvements in industrial lighting durthe last few years. These are:

First—The reduced cost of luminous flux which accompanied the appearance of lamps with reduced specific consumptions in contrast with older types. More light for the same energy consumption brought about the possibility of using higher working intensities of illumination, with an expenditure for energy well within reach of the most conservative factory managements.

Second—The gradual decrease in rates for electrical energy has still further reduced the cost of light, thus making it possible to use quantities of illumination economically to-day which only a few years ago would have been looked upon as extravagant.

Third—The appreciation on the part of engineers of many refinements in the methods of supplying light for various purposes.

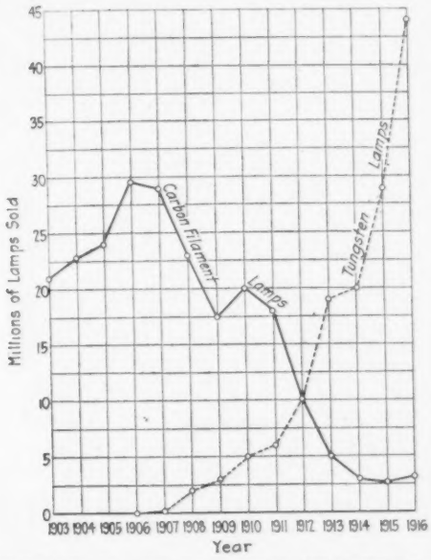


FIG. 1.—DECREASE IN USE OF CARBON-FILAMENT LAMPS AND INCREASE IN TUNGSTEN LAMPS

Fourth—The work which has been done to reduce these refinements to a practical working basis. Thus it is proper to include here such items as the manufacture of lamps in a wide variety of sizes so that the size of the unit may be adapted to the conditions surrounding its installation; the design of reflecting devices for distributing the light effectively to working surfaces, and the development of lamps possessing given spectral characteristics for producing special results as in color matching and the like.

Fifth—The growing tendency of factory owners and executives to look upon good light as a considerable asset among the list of those factors which contribute to the efficiency of production. Other influences might be

FIGS. 2, 3, 4 AND 5—TUNGSTEN AND MERCURY-VAPOR LIGHTING FIXTURES SUITED TO INDUSTRIAL PURPOSES

The tungsten lamp (Fig. 2) is equipped with an automatic safety disconnecting hanger. Fig. 3 represents an automatic starting d.c. mercury-vapor lamp for high mounting which requires little attention except for cleaning. Fig. 4 is an automatic starting, nontilting a.c. mercury-vapor lamp with special reflector for modifying the light. Fig. 5 is a quartz-type mercury-vapor lamp with a globe which is opaque to ultra-violet light and which is especially adapted to high mounting and yard lighting.

included, for example, recent legislation governing intensities of illumination for factory operations, etc.

If the owner of almost any well-lighted factory were asked at random what prompted the adoption of an adequate system of illumination, it is probably safe to say the answer would be that new types of lamps had been the basis for the interest in and decision on an improved plan of lighting as a substitute for older inferior conditions. For this reason it is natural to turn briefly to a review of the present conditions of lamp manufacture as an underlying influence of the past and probable future progress in this field of lighting.

TABLE I—DATA ON VACUUM-TYPE TUNGSTEN LAMPS*
(4 to 5 Effective Lumens per Watt Possible)

Rated Watts	Total Lumens	Mean Spherical Candlepower	Mean Horizontal Candlepower	Watts per Spherical Candlepower	Lumens per Watt
25	226	18.0	23.0	1.39	9.04
40	372	29.6	38.0	1.35	9.31
50	472	37.6	48.2	1.33	9.45
60	575	45.6	58.4	1.31	9.59
100	995	79.4	102.0	1.26	9.97

TABLE II—DATA ON GAS-FILLED TUNGSTEN LAMPS*
(5 to 7 Effective Lumens per Watt Possible)

Rated Watts	Total Lumens	Mean Spherical Candlepower	Watts per Spherical Candlepower	Lumens per Watt
75	865	69.0	1.09	11.53
100	1,260	100.0	1.00	12.57
150	2,050	163.0	0.92	13.66
200	2,920	233.0	0.86	14.61
300	4,850	385.0	0.78	16.11
400	6,150	490.0	0.82	15.32
500	8,050	640.0	0.78	16.11
750	12,800	1,020.0	0.74	16.98
1000	18,000	1,435.0	0.70	17.95

*Published through courtesy of Edison Lamp Works of General Electric Company.

The dimensions of a great majority of factory spaces make them adapted in a peculiar manner to lighting by lamps of medium size. Hence the logical tendency is to limit a great deal of industrial lighting to the use of mercury-vapor and tungsten lamps, both of which are made in sizes particularly suitable for mounting at moderate heights. The phenomenal growth in the use of tungsten lamps and decline in output of carbon-filament lamps are shown in a striking manner in Fig. 1. While these curves refer to lamps used for all lighting purposes, it is fair to assume that there has been a similar increase in the use of tungsten lamps for factory lighting as a substitute for the older forms of lamps employed, notably the carbon-filament and older carbon-arc lamps, which have so generally disappeared from the average factory, except in old installations or for special purposes.

Unlike its forerunner, the carbon incandescent lamp, the tungsten unit, as installed for general lighting, has the characteristics of an individual unit requiring special means of suspension and auxiliaries in the form of reflectors and shade holders. Sometimes even special disconnecting hangers, one type of which is shown in Fig. 2, are required for the purpose of lowering the unit for renewals and for cleaning. Moreover, renewal and maintenance do not merely consist of replacing an inexpensive lamp bulb, but involve the renewal of the larger and more expensive tungsten unit, periodic cleaning of lamp and reflector, and the renewal of the reflector, if of glass, when broken, and, if of metal, when the reflecting surfaces deteriorate to such an extent that they are no longer effective. While this work is much less troublesome than the frequent trimming associated with the older forms of arc lamps, the various items of upkeep taken together are by no means inconsiderable.

Another important lamp in the industrial field is the mercury-vapor unit in its various types. This lamp has priority over the tungsten lamp in the time during which it has been in the field. The quality of its light has been one of its greatest advantages as well as the target of numerous prejudices. Many of the adverse statements which are made concerning the quality of its

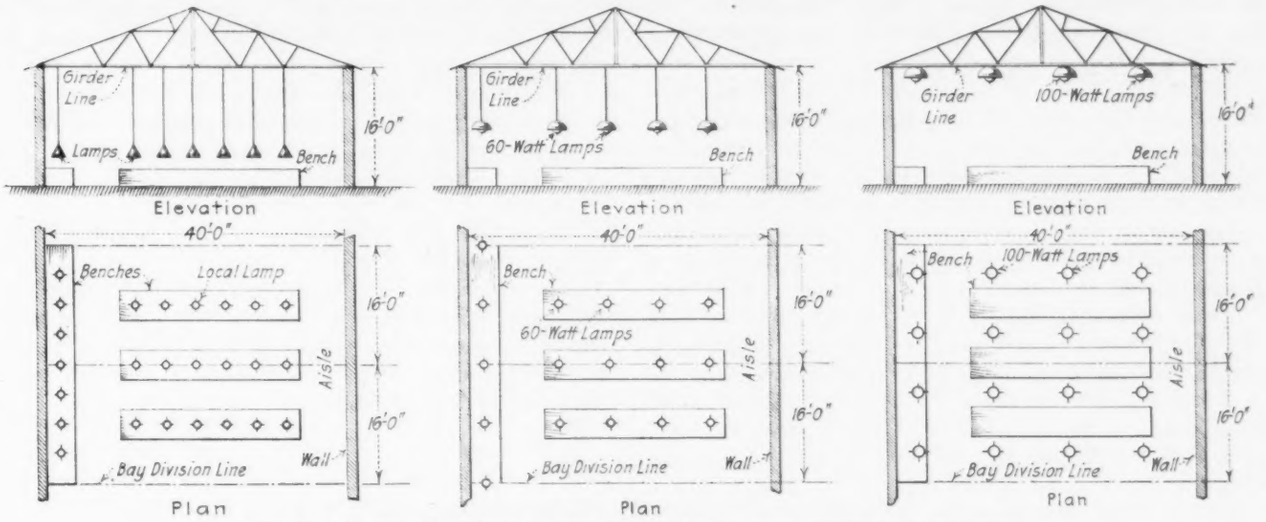
FIGS. 6, 7, 8 AND 9—INDUSTRIAL ARC LAMPS, FLOODLIGHTING UNIT AND COLOR-MATCHING LAMP

The long-burning multiple flame-carbon arc lamp in Fig. 6 is adapted to yard lighting and mounting inside at high elevations. While designed for a.c. circuits, it is also available for direct-current use. A d.c. metallic-flame arc lamp with broad distribution characteristics that make it especially suitable for yard lighting is shown in Fig. 7. The projector in Fig. 8, which is designed for any lamp rated at 300 to 1500 watts having a mogul base, is suitable for floodlighting yards and buildings for use at night or protective purposes. Fig. 9 is a carbon-dioxide daylight lamp especially useful in dyeing establishments and where color selection or comparison is necessary.

light are not only totally without reasonable foundation, but without warrant. Almost any group of employees who work under this light, if approached impartially, will testify to its superior merit as a means to clear vision and accurate visual perception. Its greatest claim

able at the present time for protecting industrial plants, as approaches which would otherwise be difficult to guard can be illuminated so as almost to equal daylight.

The employment of special units for color matching and color distinction is becoming an important feature



FIGS. 10, 11 AND 12—STEPS IN THE DEVELOPMENT OF FACTORY ILLUMINATION

In Fig. 10 local lamps are used. To secure illumination of overhead space a large lighting unit may be installed in the middle of each bay at the girder line. An arrangement of localized lamps is shown in Fig. 11 which gives better general illumination as the units are further above the benches than in Fig. 10. The illumination afforded by the arrangement of lighting units in Fig. 12 permits work wherever the benches are placed. Furthermore, the overhead space is free of drop cords.

to success at the present time depends on the vast factory areas which have been illuminated for years by this type of lamp and the many new modern plants which have selected it as the principal illuminant.

The quartz-type mercury-vapor unit, shown in Fig. 5, by virtue of its relatively high candle-power rating in comparison with the other types, has its greatest field of usefulness for yard lighting from the tops of high poles, or in factory spaces where it is possible to mount the lamps well overhead. The outer glass globe of this lamp is opaque to the ultra-violet rays which are present in the light which leaves the quartz element. Actual tests and observation of the illumination produced by these lamps when mounted 90 ft. (27.4 m.) above yard spaces show it to be superior for such purposes.*

While the arc lamp has been replaced very generally for industrial purposes by tungsten and mercury-vapor types, it is justly entitled to consideration for certain uses in some of its more recent forms. In this connection special mention may be made of the flame-carbon long-burning multiple lamps, one of which is shown in Fig. 6. Because of its large volume of luminous flux, it is suitable for certain cases of factory aisles having considerable overhead clearance as well as for yard lighting. From the standpoint of light distribution, it is superior in general to the metallic-flame or magnetite lamp (Fig. 7). The latter, with its characteristically wide light distribution at small angles below the horizontal, is adapted chiefly to those cases of lighting for vast yard spaces where the conditions approximate those of street lighting.

Still another interesting development is the adaptation of the tungsten lamp for projection purposes, notably for floodlighting large yard spaces or building fronts. Aside from the spectacular uses of floodlighting units, one of which is shown in Fig. 8, they are proving valuable in certain cases—for example, in dye works, celluloid and other plants. Considerable development work has been done in supplying lamps with spectral characteristics similar to those of natural light so that such work can be conducted in a satisfactory manner at night or on dark days. One of these units is shown in Fig. 9, this particular lamp being the carbon-dioxide tube color-matching outfit. The blue-bulb artificial daylight units, together with the various tungsten equipments, which make use of glass color screens for accomplishing the same general purpose, add to the possibilities.

TABLE III—DATA ON MERCURY-VAPOR LAMPS†

Type of Lamp	Name	Circuit	Watts (Tube)	Mean Spherical Cp.	Watts on Tube per S. Cp.	Total Watts	Mean Hemispherical Cp.	Total Watts per H. Cp.
H	Mercury vapor	D.C.	126	200	0.63	193	300	0.64
P	Mercury vapor	D.C.	252	550	0.47	385	850	0.45
PP	Mercury vapor	D.C.	504	1100	0.47	770	1500	0.51
F	Mercury vapor	A.C.	252	550	0.47	385	850	0.45
Z	Quartz	D.C.	525	1500	0.35	725	2400	0.30

†Published through courtesy of Cooper Hewitt Electric Company.

TABLE IV—DATA ON ARC LAMPS‡

Name of Lamp	Circuit	Type	Watts	Carbons	M. L. H. Cp.	M. S. Cp.	Watts per M. S. Cp.
Flame carbon.....	110-volt a-c.	Multiple	500	White	920	695	0.72
Metallic flame....	4-amp. d-c.	Series	272	Standard	495	250	1.09

‡Published through courtesy of Westinghouse Electric & Manufacturing Company.

To show some of the methods of using modern lamps, the diagrams of Figs. 10, 11 and 12 have been designed to apply to typical factory spaces, the same manufacturing conditions being shown in each of the four cases

*At the present time, owing to the lack of the necessary amount of quartz tubing from abroad, lamps of the quartz type are not available.

for convenience of comparison. These diagrams are merely representative, it being possible to carry out the scheme in a variety of ways with different types of units. The diagrams also represent graphically the development in industrial lighting from the early form of local lighting to the modern system of general illumination. In Fig. 10 a representative case of local lighting is shown, where the space immediately in front of each workman is illuminated by the small lamp housed in a deep cone-shaped metal shade. This is a decidedly poor arrangement for a number of reasons, chief of which is that the entire area is in practical darkness at night or on very cloudy days, save for the small spaces under each lamp.

With the arrangement shown, it is necessary in order to rearrange the benches for the accommodation of a change in method of manufacture to change the location of lamps correspondingly. Furthermore, an accident hazard is introduced in using the aisles as passageways, and in repairing overhead belting and line shafting, because the aisles and overhead space are in darkness. The lamps, being within easy reach, lend themselves to abuse from rough handling and to removal by any passing workman who may be in need of an extra lamp bulb. An additional disadvantage is the presence of a maze of long drop cords which detract from the openness and freedom of the space between benches and girder line. With this arrangement it is almost impossible to "keep tab" on whether the light is being wasted or not, since small lamps in such deep metal shades can burn all day long without being noticeable unless rather carefully inspected. Briefly, then, such a scheme is considered poor because of the lack of flexibility in the location of benches and work, increased accident hazard and maintenance, and the unfavorable appearance of the building, together with the likelihood of waste of light.

One of the common methods for improving this scheme in earlier practice was to install a large lighting unit here and there at the girder line. This scheme obviously has the advantage of reducing liability to accident in aisles and in overhead repair work, but it has many of the other disadvantages mentioned in connection with the arrangement shown in Fig. 10.

A plan embodying somewhat of a compromise is shown in Fig. 11, where tungsten lamps are mounted higher than the local lamps of Fig. 10, their positions being dictated, however, by the location of the benches. The permanency in the location of certain classes of machinery sometimes makes this scheme of localized general lighting desirable, and, aside from the unsymmetrical arrangements of lamps which may result from their adaptation to particular machine or bench positions, the more general distribution of light and the higher mounting of the lamps at a point overhead make this plan better than the arrangement shown in Fig. 10 or its modified form using a large lighting unit in the middle of the bay at the girder line.

The most approved plan, however, and the one now generally adopted, is that known as general lighting and indicated by Fig. 12. This is clearly distinct from Fig. 11, in that the lamps are spaced symmetrically over the working floor area and thus furnish uniform illumination on the entire space. By this means the benches or machinery may be located independently of the lighting facilities and the factory space is rendered effective throughout for manufacturing operations. It is apparent that lamps of moderate size but with luminous flux ratings greater than the carbon-filament lamp possessed have made possible a scheme like that of Fig. 12.

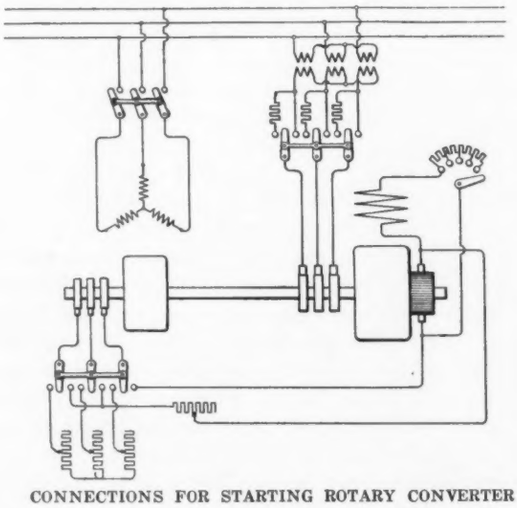
Mercury-vapor lamps may be substituted for tungsten lamps in an arrangement similar to that of Fig. 12. Instead of direct reflecting units, semi-indirect or indirect systems may be employed with tungsten lamps where the ceiling affords a good reflecting surface. The increasing luminous-flux ratings of gas-filled tungsten lamps are beginning to make themselves felt in the use of indirect lighting in such factories as textile mills, where the quality of the light for such work fills a need in the particular operations involved.

Taken as a whole, the solution of lighting problems has hinged largely on the use of new lamps. These units, in turn, have given an impetus to the discovery of ways and means for using them to the best advantage. Manufacturers are quick to perceive the wisdom of sufficient light when they realize its availability at a fair cost, and future progress must largely rest, therefore, in setting forth these advantages in a convincing manner.

STARTING ROTARY CONVERTERS

Connected to Alternating-Current Circuit So as to Apply Full Voltage Without Disturbance

A method of starting rotary converters whereby a machine may be brought up to synchronism without causing any appreciable disturbance in the supply mains is described in patent No. 1,224,729, assigned to the General Electric Company by Lionel Fleischmann. The method applies to a rotary converter which is mechanically connected with an induction motor having a phase-wound secondary. For starting, the motor is connected to the alternating-current mains as an induction motor. The slip rings of the converter are also connected to the mains but through resistance so as to apply only a portion of the normal voltage to the windings. The direct-current end of the converter is then connected to the



CONNECTIONS FOR STARTING ROTARY CONVERTER

secondary of the induction motor to supply alternating current of slip frequency. A large torque is thus produced in the motor which pulls it and the converter into synchronism. The converter may then be connected directly to the alternating-current mains, as it will be in phase, and to the direct-current buses, as it will have the correct polarity.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PROVIDING FUEL RESERVE

Springfield (Mass.) Company Plans Coal Storage to Take Advantage of Market Prices

To insure a larger fuel reserve and permit taking advantage of the market when possible, the United Electric Light Company of Springfield, Mass., has begun the construction of a 50,000-ton (45,300-t.) coal-storage installation at Indian Orchard, 7 miles (11.3 km.) east of the generating headquarters in Springfield. Open-air storage will be provided, the field being served by three virtually parallel spur tracks aggregating 1650 ft. (502.9 m.) in length. An electric locomotive crane of 6000 lb. (2721.5 kg.) capacity with a 45-ft. (13.7-m.) boom will operate upon one track in distributing and reclaiming service. The track is carried 12 ft. (3.7 m.) above the field on reinforced concrete beams and vents. Shipments of coal will be made to the new State Street riverside station in Springfield, now under construction, according to load requirements. McClintock & Craig, Springfield, are engineers for the company.

INSTRUMENT AND SWITCH TABLE FOR USE IN TESTING

Outfit Which Does Not Have Disadvantages of Testing Set-Ups Requiring the Assembly of Numerous Devices

BY A. M. HOLCOMB

Shown herewith is a generator and motor-testing table which is extremely simple in its connections, capable of holding the necessary instruments, and so arranged that both alternating-current and direct-current readings can be made accurately and quickly. The wiring diagram and view of the table show how the circuits and table are arranged. When used with direct-current motors and generators the upper wire carries the field current and the armature circuits pass through the two lower wires. The middle switches are for ammeter protection.

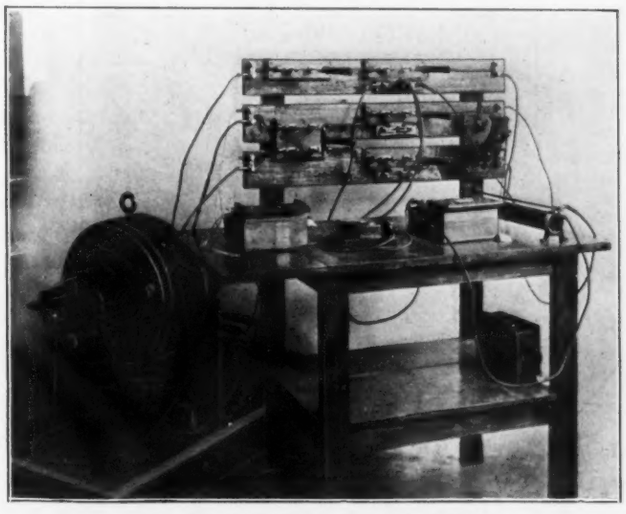


FIG. 1—SIMPLIFIED TESTING TABLE

For three-phase tests the wiring arrangement shown in Fig. 2 is used. The plug has two brass projections

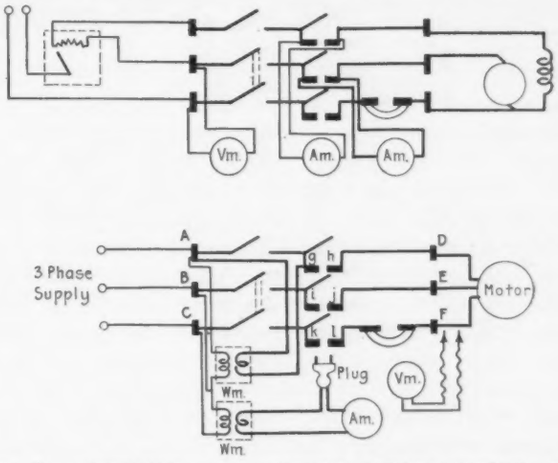


FIG. 2—CONNECTIONS FOR TESTING DIRECT-CURRENT AND THREE-PHASE MACHINES RESPECTIVELY

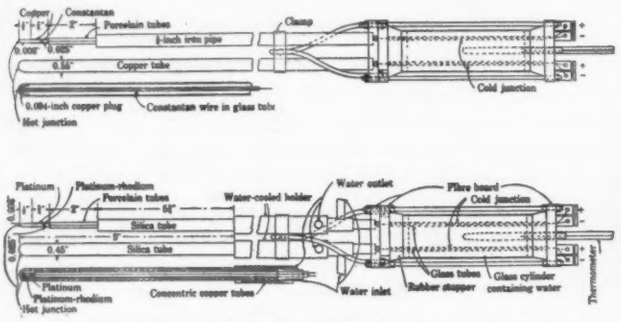
which fit into blocks beneath the short-circuiting switches. When reading power by the two-wattmeter method, the plug must be placed in circuit *C* with switches *Ag* and *Kl* open. This arrangement protects the current coils of both wattmeters when *Ag* and *Kl* are closed. Under ordinary circumstances, if the potential circuit is opened, the meter is sufficiently protected and the current coils can be in the lines beyond *D* and *F*. All terminal blocks have two holes with knurled set screws. Voltmeter leads and line leads are held under these set screws. The tables have been in use for some time and are very satisfactory.

MEASURING FURNACE HEAT

Thermocouples Made with Two Combinations of Metals Found Satisfactory

Two kinds of thermocouples were recently used in measuring temperatures of gas-fired boilers which might be considered by central station engineers for permanent attachment to boiler furnaces. One couple, made of copper and constantan, was used for temperatures up to 900 deg. Fahr. (500 deg. C.), and the other, consisting of platinum and rhodium, for all higher temperatures. The details of both of these couples are shown herewith. The hot junctions in both of the small couples were made of short pieces of wire, 0.008 in. (0.2 mm.) in diameter, welded to larger wires in order to obtain mechanical strength and to prevent sagging of the projecting parts. In each couple the dissimilar

wires forming the hot junction are kept uniform in diameter without the formation of the usual head. The large copper-constantan couple consists of a thin-walled copper tube, 0.550 in. (14 mm.) outside diameter, having a cup-shaped copper plug rolled into one end. Constantan wires, 0.025 in. (0.53 mm.) in diameter, were peened into these plugs to make the hot junctions.



CONSTRUCTION OF COPPER-CONSTANTAN AND PLATINUM-RHODIUM THERMOCOUPLES

Glass tubing was used to insulate the constantan wires placed in the copper tubes. The large platinum couples were made of wires 0.025 in. (0.53 mm.) in diameter. The hot-junction end of the couples was placed in a closed-end silica tube about 11 in. (27.9 cm.) long and fitted into a water-cooled metal holder. The closed-end silica tubes had an outside diameter of 0.450 in. (1.14 cm.). Inasmuch as it was the outside surface of these tubes which received and radiated heat, this construction gave the same readings as would have been obtained with couples made of a large platinum tube the same size and shape as the copper tube. The length of the silica tubes was sufficient to make negligible any lowering of temperature of the closed end due to conduction of heat to the water-cooled holder. The water-cooled holder of the platinum couple was made of three concentric copper tubes arranged in such a way that the cooling water flowed through a circuit twice the length of the holder. The outside tube had an outside diameter of 0.75 in. (1.9 cm.). The cold junctions of the couple were placed in a water bath attached to the cold end of the couples. These thermocouples were described by Henry Kreisinger and J. F. Barkley in a paper presented at the spring meeting of the A. S. M. E.

SELECTION OF COAL

Advisability of Basing the Specifications for Coal on the Fusibility of the Ash

Coal the ash of which does not melt below 2400 deg. Fahr. (preferably a little above this figure) is a very good power-house coal because the ashes remain in small particles, form small clinkers, and do not fuse together and make a big sheet of slag over the grate. An ash which clinkers below 2400 deg. causes a great deal of trouble through obstruction to the air supply feeding the fire. The New York Edison Company, Commonwealth Edison Company of Chicago and other companies have been studying the ash content of coal with a view to the possibility of incorporating in coal specifications a laboratory test of fusibility of ash. These points were brought out recently by C. H. Parker, assistant superintendent of generation Boston Edison Company.

TRUCK FOR HAULING POLES

Motor Truck Equipped with Trailer and Removable Bolster Upon Which Entire Load Swings

The stores department of a large company uses the truck shown in the accompanying illustration for hauling poles, especially where it is necessary to haul less than a carload of poles to some suburban pole yard. It is also used occasionally in an emergency to help out the maintenance department. The only changes which were

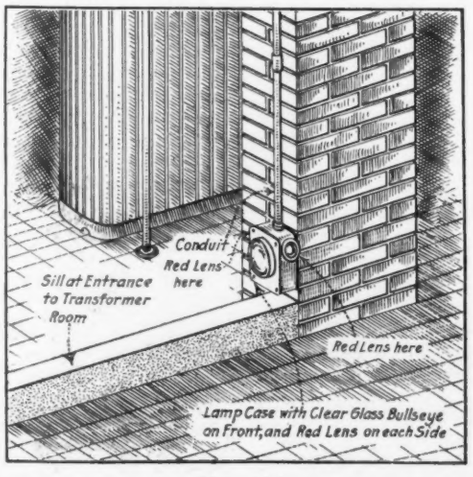
TRUCK EQUIPPED WITH TRAILER FOR HAULING POLES

made in the truck were the addition of a device in the rear for attaching the tongue of a trailer and the use of a removable swivel bolster upon which the entire load swings, thus enabling the truck to turn corners easily. The truck and trailer shown herewith are loaded with forty-six 30-ft. (9.1-m.) poles with 6-in. (15.2-cm.) tops. With shorter poles the load is about evenly divided between the truck and the trailer, while with longer poles the trailer carries most of the load.

PREVENTING ACCIDENTS

Electric Bull's-eye Used to Illuminate Sill at Entrance to Transformer Room to Prevent Stumbling

At the State Street station of the United Electric Light Company, Springfield, Mass., a transformer-room floor is separated from the rest of the station by a concrete door sill 4 in. (9.16 cm.) high, to guard


Conduit
Red Lens here
Sill at Entrance to Transformer Room
Red Lens here
Lamp Case with Clear Glass Bullseye on Front, and Red Lens on each Side

LAMP FOR ILLUMINATING RAISED SILL, WITH RED LIGHT SUGGESTING CAUTION

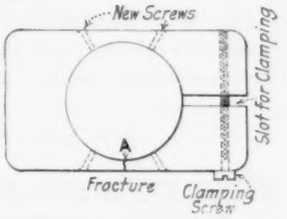
against the flow of oil in case of trouble. To prevent stumbling at the sill an 8-cp. 140-volt pilot lamp has been installed in an iron box at one end of the sill, as shown. Red bulls'-eyes are set in the box at the sides, to serve as a warning, and a clear-white glass is provided at the front to illuminate the sill. By running the lamp at 115 to 120 volts its life is greatly increased.

REPAIRING CRACKED FIELD-POLE SHOE

Fracture Is Welded, Clamping Screws Are Removed and Set Screws Are Inserted in Order to Hold Shoes to Pole

BY H. L. HEARVEY

A cast-iron field-pole shoe of a ½-hp. bipolar direct-current motor cracked as shown at *A*, allowing the shoe to rub against the armature. The frictional heat which developed soon completely ruined the armature coils, necessitating their rewinding. The shoe was taken off and welded with an acetylene torch. Further examination revealed a crack similarly situated in the other shoe, but it had not moved while the motor was in use as it fitted the pole more tightly than the shoe which had caused the trouble. These weak places were reinforced by building them up while welding.



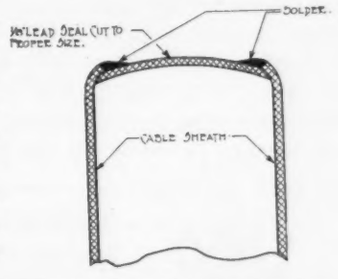
CRACKED POLE SHOE THAT WAS REPAIRED

In order to prevent the recurrence of this accident it was decided to hold the shoes in place with screws passing through their sides and into the poles instead of by the clamping screws which had been employed up to this time. To facilitate this work the field coils were removed, and the armature was inserted so that the shoes could be properly placed. Then the shoes were clamped in position and drilled and tapped for No. 8 flat-head iron screws. The coils were then replaced, the shoes were screwed permanently in position, and the motor was put back in service, where it has given no more trouble.

SEALING ENDS OF CABLES

Lead Disk Laid in Recess Made in End of Cable and Soldered to Sheath Belled Over It

Proper sealing of cable ends is of importance because of the danger of absorption of moisture by the cable insulation when sealing is not properly done. Several large operating companies use the following simple and effective method of sealing cables. The first step is slightly to bell out the lead sheathing around its entire circumference. Then, approximately ¼ in. (0.64 cm.) of the core of the paper insulation around the conductors is removed. A lead disk, ⅛ in. (0.32 cm.) thick and slightly convex, is carefully scraped to insure the solder taking hold and is placed over the end of the cable inside the projecting sheath. The belled edge of the sheath is bent up over the edge of the cap, which is then thoroughly soldered to the sheath, as shown in the accompanying illustration. The solder, which increases the thickness of the cap, makes a water-tight joint and is strong enough mechanically to protect the cable from injury. This method of sealing cables was described in the report of the N. E. L. A. committee on underground construction and electrolysis, of which E. B. Meyer is chairman.



METHOD OF MAKING LEAD SEAL FOR CABLES

DISTRIBUTION-LINE ECONOMIES

How to Balance Transformer Expense Against Copper Expense in Laying Out a System

Some interesting views on considerations influencing selection of transformers were brought out in a recent paper, by S. B. Hood of the Minneapolis (Minn.) General Electric Company. Since the price per kilovolt-ampere of transformer rating decreases as the size increases it naturally follows that the larger sizes should be used wherever practicable. This can be accomplished usually by stringing heavier and longer secondary bus lines and feeding them with a smaller number of units. The most economical balance is obtained as regards initial investment when the cost of secondary bus lines plus transformers is a minimum. There is, however, a very wide difference between the depreciation on copper wire and on transformers. Wire depreciates very slowly and has a high fixed salvage value. Transformers have an uncertain life and their scrap value is low. Taking these conditions into consideration, it is good practice to spend considerably more on bus copper than is actually required to strike an economical balance. An excess copper investment equal to 50 per cent of the transformer cost is not too much to allow.

As an example, take two secondary bus sections, each fed by 5-kva. transformers, the investment on which, in position, will be about $150. By connecting these bus lines and substituting a 10-kva. transformer, advantage is taken of the diversity on the bus, thereby permitting the connecting of more load. The new transformer investment will not exceed $95, showing a saving of $55 that can be spent for connecting and increasing the size of the secondary bus and still maintain a balance as regards investment. Assuming interest at 6 per cent and depreciation at 7.5 per cent, the annual charges will be $20.25 and $12.82 respectively, showing an annual saving of $7.43 by using one unit in place of the two. Now, if interest is assumed at 6 per cent and depreciation at 2.5 per cent on copper wire, and this saving is capitalized, it will be possible to spend $87 plus the $55, or $142, on the secondary bus and still maintain an economical balance. This makes no allowance for the saving due to lower core loss with the single unit as compared with two smaller units. If this were taken into consideration, a still greater secondary investment could be justified. In purchasing transformers it is very poor policy to stock the small units. A 5-kva. unit is small enough to use regularly on any system of distribution.

As regards ratios and taps for distribution transformers, 2300-volt primary and 115-230-volt secondary windings without taps give the best all-around results. These will operate over a primary range of 2200 to 2400 volts. Taps have no real advantage and introduce complication in the end turns where the greatest strength is required. The double primary winding used in earlier days is of no use at present, and its omission together with that of taps makes possible the elimination of the primary terminal board which has been the cause of so many transformer failures.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

GETTING THE ANSWER ON NEWSPAPER ADVERTISING

How an Analysis of a Community's Habits Helped Make Central Station Advertising More Effective

An exact reproduction in one city of advertising used with great success in any other city would not necessarily be successful in the same measure. At least this is the opinion of the commercial department of the Mahoning & Shenango Railway & Light Company of Youngstown, Ohio. The men who plan the advertising for this company believe that local conditions in each city must be analyzed, and then the advertising must be written and used in accordance with the conditions found to bring the greatest success. An analysis was made at Youngstown.

It was formerly believed that selling electrical goods entailed so much educational effort that any over-the-counter merchandising attempt was ultra-expensive. But a great deal of the buying in this city is over-the-counter buying. Youngstown is a great Saturday-buying city. Counters and aisles are literally lined with buyers on Saturday afternoon and evening after the steel mills have paid employees. Friday newspapers consequently carry the heaviest advertising sections of the week.

A study of the general run of this advertising showed that it was very black, heavy and closely set. When it was decided that the central station should also try to get some of this Saturday business it was planned to make the advertising different and to attempt to promote the sale of only the merchandise which is readily salable over the counter. Accordingly all advertisements were set in type which would give them a light, readable appearance in contrast with the remainder of the black, heavy page. Some experimenting with different sizes of space was tried, but it was soon discovered that four inches deep and five columns wide gave the best results for the money. That the method of analysis was correct has been proved by the increase in the sales of the goods advertised.

Educational advertising is still done occasionally, but such material never appears in the Friday papers. It is run in Sunday papers or earlier in the week, when people are taking more time to read and think and are therefore in a receptive mood.

WHERE TO START YOUNG MEN WHO WANT TO MAKE PROGRESS

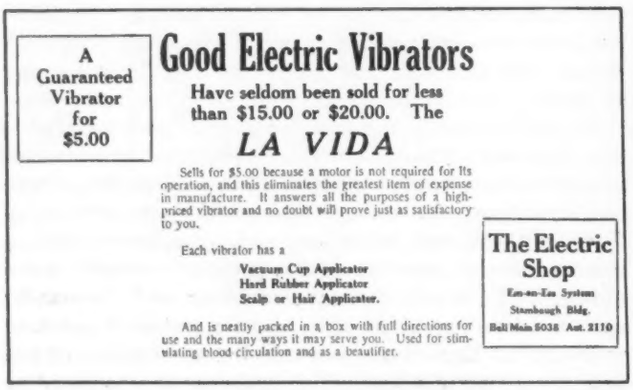
Letting Them Read the Meters Affords Companies Opportunity for Making Better Contact with Their Customers

It is frequently difficult to decide where to start promising young men who have no special technical training. Central stations, like other concerns, are continually having applications from young men who are just starting out. Some of these fellows appear promising, but the company is frequently at a loss to know what to do with them. Undoubtedly in a few years they will develop into valuable employees if they can only get the proper start.

Two companies, one in the East and one in the Middle West—undoubtedly there are more—have found the way out of this difficulty, and very satisfactorily too. All intelligent and eligible young fellows are started in the meter department. The men are given to understand that they are expected to grow and develop. In fact, they receive every opportunity to do so.

Incidentally these companies make contact with customers through ambitious young men who have the best interests of their company at heart. Better meter readers are obtained, better and more careful meter reading results, with fewer mistakes, and consequently there are fewer complaints—all the result of employing men who do not consider meter reading the maximum of attainment.

The point of contact with the customer is very important. If a bright, clean young fellow shows up to read the meter, the impression left with the customer is much more favorable to the lighting company than it


A Guaranteed Vibrator for $5.00
Good Electric Vibrators
Have seldom been sold for less than $15.00 or $20.00. The
LA VIDA
Sells for $5.00 because a motor is not required for its operation, and this eliminates the greatest item of expense in manufacture. It answers all the purposes of a high-priced vibrator and no doubt will prove just as satisfactory to you.
Each vibrator has a
Vacuum Cup Applicator
Hard Rubber Applicator
Scalp or Hair Applicator.
And is neatly packed in a box with full directions for use and the many ways it may serve you. Used for stimulating blood circulation and as a beautifier.
The Electric Shop
Ess-an-Ess System
Stambaugh Bldg.
Bell Main 5038 Aut. 2110

Piping Hot Breakfast
$5.00, $6.00 or $7.00
$6.00 or $7.00
$4.00, $5.00 or $6.00
$3.85 or $6.50
Another Small Lot Of
Hughes Auto Heaters
Has been received at the Electric Shop. If you are using your car these cold days you will find this Electric Heater serves a very useful purpose.
It keeps your carburetor and engine warm and ready for a quick get away.
Price, $4.00
The Electric Shop
of the
Ess-an-Ess System
Stambaugh Building
Bell, Main 5038 Auto. 2110
ADDITIONAL WARMTH
The American Beauty Radiator
Costs Only
$6.50

SAMPLE ADVERTISEMENTS USED TO GOOD EFFECT BY OHIO CENTRAL STATION COMPANY

would be if a man whose appearance suggested an earning power of about $10 a week knocked at the door. Certainly the customer would be less likely to suspect the meter reading.

STEEL METER RECORD FILE ARRANGED TO RUN ON WHEELS

Convenient Fireproof Contrivance So Designed that It Can Be Wheeled Into the Vault at Night for Safekeeping

Meter records, of course, are invaluable to a central station, and therefore every precaution is taken by careful companies to keep them safe. Where cards are used an excellent device for keeping these records may be patterned after the steel card file used by the Rockford (Ill.) Electric Company.

The file consists of sixteen 5-in. by 8-in. (12.7-cm. by 20.32-cm.) and eighteen 3-in. by 5-in. (7.62-cm. by 12.7-cm.) drawers. The over-all dimensions are: Width, 41 in. (104.14 cm.); height, 53 in. (134.62 cm.), and depth, 18 in. (45.72 cm.).

A RECORD FILE THAT RUNS ON WHEELS

On the front of each drawer is a combination handle and card frame allowing the insertion of a card designating the contents. The whole file is mounted on a set of four rubber-tired wheels set with ball bearings, two carrying the greater part of the weight and mounted directly upon the axle. The other two, which act as guide wheels, are mounted directly underneath and are of swivel type, readily turning in any direction. To each end is fastened a handle used in pulling or pushing as desired. Every morning the file is wheeled into the meter department, and every evening it is taken into the vault for safety.

RATE TENDENCIES AND RECOMMENDATIONS THEREON

Rate Research Committee Discusses Point of Incidence of Follow-On Rate and Variation of Rates with Fuel Costs and Power Factor

One of the very valuable reports presented at the annual convention of the National Electric Light Association is that of the committee on rate research. This year's committee, headed by Alex Dow of Detroit, discusses rather fully three topics of more than passing interest: (1) the point of incidence of a follow-on rate; (2) rates varying with the fuel costs, and (3) rates varying with power factor. In connection with these topics the committee has the following to say in part:

THE POINT OF INCIDENCE OF A FOLLOW-ON RATE

"The mistake is often made of comparing the maximum rates of different companies without considering the conditions of application of a secondary or follow-on rate. With the differentiations and careful adjustments of electric rates now in force in the industry, it becomes necessary, in order to a proper understanding of rate schedules, to take into account not only the base or maximum rate, but the secondary or follow-on rate and its point of incidence. The fact that, for instance, the base rate of a company is 12 cents per kilowatt-hour is not sufficient justification for the inference that its rates are higher than those of a company charging 10 or 9 cents per kilowatt-hour, because in the former case the secondary rate may apply after a shorter number of hours of use of the demand per month or for a lesser number of kilowatt-hours' consumption per month than in the latter case.

"There is a wide divergence in the practice of different companies with regard to the point of incidence of the secondary or follow-on rate. In some instances it may be effective after, say, twenty-five hours' use of the demand; in other cases after 120 hours' use of the demand. In the former case the company may intentionally have selected as the point of incidence the point corresponding to economical use of light, with intent to encourage liberal use of lamps or of appliances. In the latter case the prior maximum rate may have been unduly low, but the divergence may indicate a lack of comprehension of the conditions which should determine the point at which the follow-on rate should apply, and the matter is therefore well worth special attention by those who may be considering changes in their rates.

"Perhaps the most common method has been to select the point of incidence according to the amount of reduction of earnings desired to be effected.

"The point of incidence may be separately determined as between different classes of customers: thus, if it is desired to promote larger use by individual customers of all classes, and if it has been determined that the commercial lighting class has a condition of load factor, or average use, different from that of the residential lighting class of customers in the same company, it would be perfectly proper to apply the secondary or follow-on rate for all consumption by commercial customers over a number of hours' use of the demand which is considerably greater than the lesser number of hours' use required of residential customers; or, if it is determined that a certain class of commercial customers, to whom it is desired that a stimulus be applied in the

form of a low follow-on rate, can be counted on to use, say, 150 hours of the demand per month normally, and if the similar normal use by residence customers proves upon investigation to be thirty hours, then it would be proper to apply the secondary rate for the respective classes only when the consumption reaches such number of hours' use.

"Several methods of treating this point of incidence of the follow-on rate have been used in actual practice, with the desirable effect of minimizing the number of meters, the number of contracts, the expense of billing, and the investment and maintenance costs in connection with meters, the intention being to enable customers to receive a differentiation in rate between lighting service and power service and yet supply the entire service through a single meter.

RATES VARIABLE WITH FUEL COSTS

"The present high cost of fuel demands that earlier rates for large blocks of energy generated by the combustion of fuel be reconsidered. The variations in fuel costs from month to month, and almost from day to day, make impossible any permanent or semi-permanent readjustment of such rates. The committee suggests that a 'standard rider,' attachable to existing forms of contracts and forming part thereof, and providing for variation of rate with variation of fuel cost, is the most convenient method of dealing with the present problem. Such a rider may state a normal price for a specified fuel having a thermal value within certain limits, f.o.b. at a recognized receiving point, and an additional charge per kilowatt-hour when cost exceeds that normal price. If there is a coal exchange or similar institution, whose published average prices per month are accepted locally as authoritative, these published prices may be made the basis of the billing; but in almost every case the actual price paid by the member company, averaged for the month or other billing period, and certified to by its auditor, will be the only available basis. If the 'normal' price for fuel is specified at any figure above a certain minimum, of course the rider should provide for reduction as well as for increase of rate.

RATES VARYING WITH POWER FACTOR

"The committee has discussed at length the merit of a power-factor specification in contracts for the supply of energy in large quantities. It appears that such a specification is seldom written in, and when written is not always enforced. It also appears that there should be a difference in our dealings with the power factors ordinarily associated with industrial power loads and those exceptionally bad power factors which not only cause excessive investment in generating apparatus and transmission copper but disturb the service to consumers other than the offender. It should be remembered that at 70 per cent power factor the heating of all conductors is doubled, in comparison with the heating at 100 per cent, and presumably the carrying capacity is likewise halved. Certainly the regulation of a transformer or a transmission system is less than half what it would be at 100 per cent.

"The unbalancing of polyphase circuits due to large single-phase loads was, in committee discussions, considered to have a like undesirable standing with low power factor. For instance, the use of several single-phase welders or a group of small single-phase furnaces which could be balanced out, one against the other, more or less completely by sequent connections on the different phases of the system was held to be reasonable, but a demand that we should serve a large single-phase furnace or a single-phase railway at the rates quoted for balanced loads was held to be unreasonable. The burden of balancing such loads should be the consumer's.

"The committee suggests that there is a limit to correction or compensation of these disturbing influences by rate making alone, and that certain disturbances should be debarred by penalties rather than measured and settled for as incidents of service.

"The committee suggests, as a basis for discussion only, and not as a fully considered recommendation, that a satisfactory power factor rule should (a) accept without charge or penalty power factors from unity down to (say) 85 per cent; (b) increase the rate suitably for power factors from 85 per cent down to 75 or possibly 70 per cent, and (c) penalize by a rapidly increasing surcharge all power factors of 70 per cent or less.

"Unbalancing of a character and extent which will cause disturbance and expense is usually accompanied by very low power factor and would be collaterally penalized; but it is properly a subject for corrective engineering rather than corrective rate making. Such a serious case of lack of balance as power supply to a single-phase railroad is not to be dealt with by any general schedule."

THE PROFIT TO A COMPANY ON A LAMP SALESMAN

Indiana Sales Manager Points Out that Seven-Hundred-and-Fifty-Dollar Man Earns Practically Double His Salary for the Utility

In a campaign to sell 100 reading lamps new to Indianapolis one of the local lighting companies, the Merchants' Heat & Light Company, with twenty salesmen on the outside, disposed of sixty lamps the first day and the remaining forty the next. The campaign was considered quite successful, in spite of the fact that the department had had no special previous training in selling reading lamps.

The reason the sale is considered so successful is given by R. A. MacGregor, sales manager of the Merchants' company, as follows: "A residence salesman who will produce an average of one and one-half new customers a day is considered a crackajack. His salary is usually $750 a year. One and one-half customers a day gives a total of 450 a year, which on the average revenue of $12 per customer a year means $5,400. In other words, the central station company is glad to spend $750 for a man who will produce $5,400 a year revenue.

"The men selling reading lamps for the first time averaged three lamps apiece a day, so that it does not seem too much to expect that they with training could sell 1000 lamps a year. The profit to a central station on 1000 lamps is $1,450. The equivalent revenue would be $6,000 a year. From these figures it is pointed out that the same effort devoted to the service of the regular customer would develop $600 more revenue per year, and the salesman would pay the company $700 in profit for holding his job at the same time. In addition to this the selling of lamps has the additional feature that it goes where a service and meter are already installed, and requires no additional line investment."

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

PHOTOMETRY OF LIGHTS OF DIFFERENT COLORS

Experiments with the Flicker Method Seem to Establish for It Advantages of Accuracy in Measurement and Reduction of Labor

IN RECENT years photometry is being looked upon more as an exact science, and in some cases tenths of 1 per cent are considered important quantities. However, it is only when conditions are most favorable, and in particular when the lights compared are closely similar in color, that accuracies of this order can be approached. As soon as any perceptible difference of color appears the certainty of measurements is distinctly reduced. For example, in the most careful interlaboratory comparisons made with a standard Lummer-Brodhun photometer systematic differences of nearly 2 per cent have occurred when the color difference involved was that between the primary carbon standards and vacuum tungsten lamps. This particular difficulty was satisfactorily met by tacit general agreement on certain values for vacuum tungsten standards, but it arose again in aggravated form with the advent of gas-filled lamps, which give decidedly whiter light than the vacuum lamps. Still greater color difference is involved in rating arc lamps, gas mantles and other selectively radiating illuminants, reaching the extreme in the mercury-vapor lamp and in the comparison of monochromatic lights.

NECESSITY FOR IMPROVED METHOD

It has become increasingly evident that if any systematic and general method of comparison of lights is to be established, some method other than that of the accepted standard photometers must be used. Of all the other possible means of measurement, the only one which has apparently given promise of being a decided improvement is the use of the flicker principle. The work of H. E. Ives established the practicability of the flicker method and gave a fairly complete experimental basis for specifications covering the procedure to be followed.

In 1915 the Bureau of Standards, in collaboration with the research committee of the Illuminating Engineering Society, undertook an extensive trial of the flicker instrument, following in general the proposals of Ives and his collaborators. A report on this work was given before the Illuminating Engineering Society in 1916 by Crittenden and Richtmyer (see ELECTRICAL WORLD, Vol. 67, page 415, Feb. 19, 1916). Since that time the flicker method has been further tried out at the Bureau of Standards on a considerable variety of work, and a proposal has now been made that the research committee formally recommend the adoption of that type of photometer as the standard one for the comparison of lights of different colors. The bureau is issuing as Scientific Paper No. 299 the report mentioned above, with the title "An Average Eye for Heterochromatic Photometry, and a Comparison of a Flicker and an Equality-of-Brightness Photometer."

The results emphasize the fact that for accurate heterochromatic measurements a systematic choice of observers is essential. The method proposed by Ives and Kingsbury appears to be practical and reliable, at least for color differences of the type dealt with in these tests. The ratio of transmission found for specified yellow and blue solutions is a test as to whether the individual eye agrees with the average, and if not, correction to a comparison of lamps made by an individual eye can be applied from the data given in the paper. Hence for color differences of this type any observer may be used and his results corrected to the normal.

With regard to certainty of measurement the flicker photometer shows a decided advantage, even with small color differences. With regard to relative results, for sources having relatively high intensity in the blue the values given by the flicker photometer differ from those obtained by the Lummer-Brodhun photometer as generally used. Besides increased certainty, the flicker method reduces considerably the labor necessary to attain a given accuracy.

AVERAGE RELATIVE VISIBILITY OF RADIATION
(125 OBSERVERS)

Wave-Length, Microns	Visibility, Per Cent	Wave-Length, Microns	Visibility, Per Cent.
0.40	0.010	0.58	0.898
0.41	0.017	0.59	0.800
0.42	0.024	0.60	0.687
0.43	0.029	0.61	0.557
0.44	0.033	0.62	0.427
0.45	0.041	0.63	0.302
0.46	0.056	0.64	0.194
0.47	0.083	0.65	0.115
0.48	0.125	0.66	0.065
0.49	0.194	0.67	0.034
0.50	0.316	0.68	0.018
0.51	0.503	0.69	0.0085
0.52	0.710	0.70	0.0040
0.53	0.862	0.71	0.0020
0.54	0.954	0.72	0.0010
0.55	0.994	0.73	0.0005
0.56	0.998	0.74	0.0003
0.57	0.968	0.75	0.0002

One of the fundamental facts involved in photometry is the variation of visibility of light with its wave length. This also has been studied recently at the Bureau of Standards, and the results will soon be issued under the title "Relative Sensibility of the Average Eye to Light of Different Colors, and Some Practical Applications to Radiation Problems," by W. W. Coblentz and W. B. Emerson.

The determination of a visibility curve requires the measurement of the radiant energy—or, more properly, power—distributed through the spectrum, as well as the light. The facilities available were such that the measurements of the radiation in this case were more

reliable than in any previous work of this kind, in the opinion of the investigators. The light was measured by a flicker photometer following the proposed standard specifications except in regard to brightness of field. The field was a magnesium-oxide surface with an illumination of 50 meter-candles, viewed through an artificial pupil measuring 0.5 mm. by 2.6 mm.

Taking an average of data obtained with 125 observers, the relative visibility of radiation of different wave lengths was found to be as shown in the accompany table, the maximum value (at 0.5576 μ) being taken as unity.

The data given agree very closely with the transmission of the most recent physical-photometer luminosity solution proposed by Ives and Kingsbury, except in the green. A modified solution, in which the transmission coincides more closely with the observed visibility curve, is described in an appendix to the paper. Comparison of the spectral energy distribution of the acetylene flame used in this work with that used by Nutting indicated that the outstanding differences between the Nutting visibility curve and that mentioned were largely due to differences in the energy measurements. If the Nutting curve is corrected in accordance with these later measurements of the energy, the agreement becomes as good as could be expected in view of the known variations of individuals from the mean curve. Measurements at five points in the spectrum were also made by equality-of-brightness settings. These were so much more erratic than the flicker measurements that no very definite conclusions could be drawn, but there seemed to be a tendency toward a broader curve than that given by the flicker photometer.

Generators, Motors and Transformers

Deterioration of Turbine Blades.—A. FENWICK.—Conclusion of an abstract from the *Proceedings* of the South African Institution of Engineers. In summarizing the behavior of materials used for turbine blades it was pointed out that 5 per cent nickel-steel, brass and aluminum bronze in suitable stages will have a life of 40,000 hours, and perhaps 50,000 or more, which, if the turbines are run continuously, means five or six years. Nozzles with thin cast-iron vanes should be abolished, but if cast-iron is used the design should be such that there is no possibility of pieces becoming detached. High-percentage-nickel steel has been more extensively used and for a much longer period than non-nickel steel. The evidence is, however, very much in favor of mild steel. The cast-in method of attaching blades is very simple and requires a minimum amount of machining and fitting, so that it would be preferable to retain the design if satisfactory results can be obtained. The author believes that considerable improvement can be made by the use of thicker blades of mild or low-percentage nickel steel. The behavior of aluminum bronze and high-percentage nickel-steel running blades in various stages indicates that these materials are unsuitable for use at high temperatures. The first indication of the cracking of guide blades is always at the inlet side of the blade, and these cracks then extend cobweb fashion over the surface of the blade. There was a considerable amount of evidence to show that deterioration was more rapid on machines which carry a fluctuating load.—London *Elec. Review*, May 11, 1917.

Generation, Transmission and Distribution

High-Tension Overhead Transmission Lines.—G. V. TWISS.—The second installment of the author's paper on this subject. Among subjects discussed therein are the factors of safety required in Great Britain, Canada and the United States, relative merits and fields of pin-type and suspension-type insulators, and the mechanical design and testing of insulators. Curves are given that facilitate the calculation of line costs.—London *Electrician*, May 11, 1917.

Phase Transformation.—G. FACCIOLI.—An article which demonstrates how both voltage and current at quadrature with a single-phase source of supply can be obtained by means of inductance. By this method it is impossible to derive a balanced polyphase system because in each case where quadrature current is derived there is an excess of power delivered to one phase.—*General Electric Review*, May, 1917.

Installations, Systems and Appliances

Coherers.—E. C. GREEN.—Early observations of coherer action, description of a new type of coherer developed recently for lightning-arrester and high-frequency alarms, and comments on some theories that have been advanced to explain coherer action.—*General Electric Review*, May, 1917.

Rating of Auto-Starters.—A long editorial in which attention is called to the great variety in the methods of rating auto-starters. Five such methods are described as follows: (a) Starting motors of their rated horsepower against full-load torque during a maximum period of one or one and a half minutes in the starting position, to be followed by a running period or rest period of not less than ten times the starting period. If the starting period is, say, only half a minute, then two starts may be made with one-minute rating, or three with a rating of a minute and a half. (b) Starting with twice full-load current from the line, with the motor connected to the 50 per cent tap, at intervals of thirty minutes for a starting period of one and a half minutes, with a temperature rise not exceeding 70 deg. Fahr. (21.1 deg. C.). (c) Auto-transformers are rated to take from the mains a current not exceeding two and a half times the full-load current of the motor, with the motor connected to any tapping, for a period not exceeding one minute or one and a half minutes, followed by a cooling period of at least ten times the starting period, for an indefinite number of times, with a maximum temperature rise not exceeding 100 deg. Fahr. (37.8 deg. C.) (measured by the increase of resistance of the winding). (d) With full-line voltage applied to line terminals and current taken from taps giving between 40 per cent and 60 per cent of the normal line voltage, 300 per cent of full-load current applied for the first fifteen seconds of each four-minute period for not more than one hour must show no resultant flaming or molten droppings. The oil, if any, in which the transformer windings are immersed shall not overflow the containing case. (e) With full-line voltage applied to line terminals and current taken from taps giving between 40 per cent and 60 per cent of the normal line voltage, 250 per cent of full-load current applied for three minutes, followed by a cooling period of one hour with a maximum temperature rise not exceeding 100 deg. Fahr. (37.8 deg. C.) measured by thermometer. Some of these methods are briefly criticised,

and it is urged that the engineering standards committee should bring the makers and users together and draw up specifications acceptable to both.—London *Electrician*, April 27, 1917.

Electrochemistry and Batteries

Electrolytic Treatment of Zinc Ores.—E. E. WALTS.—From experiments outlined in this paper the following conclusions were made: (1) Successful electrolysis is impossible in the presence of sulphurous acid or zinc sulphite. (2) Successful electrolysis is possible with an electrolyte of zinc sulphate to which zinc oxide prepared in any suitable manner is charged to compartments surrounding the anodes of the cell. (3) Lead forms a satisfactory anode, and copper, zinc and aluminum form satisfactory cathodes. (4) With current densities of from 2.5 amp. to 4.5 amp. per square decimeter, a current efficiency of approximately 100 per cent can be maintained. (5) Depending upon the current density, the voltage varies from 3.5 volts to 6 volts. (6) The extraction of zinc from zinc oxide varies from 95 to 100 per cent. On the basis of a steady production of 60,000 lb. per month, or 2000 lb. per day, the writer estimates that the cost of producing zinc electrolytically could be 4 cents per pound when power is available at $14 per horsepower-year. The cost in cents per pound would be distributed as follows: Crushing, pumping, filtering and purifying, 0.6; electrolysis, including power, labor and repairs, 2.3; melting 0.8, and general, 0.3.—*Met. and Chem. Engineering*, June 1, 1917.

Electrophysics and Magnetism

Electrostatic Capacity of Three Parallel Cylinders.—F. E. PERNOT AND E. N. D'OYLY.—J. J. Thompson has shown how to determine the capacity per unit of length of two infinitely long parallel cylinders by the method of successive images. The present authors show how to apply the same method to the determination of the electrostatic capacity of three parallel cylinders. The paper is of a highly mathematical nature.—*University of California Publications, in Engineering*, Vol. I, No. 10, Feb. 10, 1917.

Fatigue of Nickel and Iron Wires Under the Influence of Transverse Alternating Magnetic Fields.—W. BROWN.—Experiments were made on the fatigue of nickel and iron wires when subjected to the influence of transverse alternating magnetic fields of a frequency of 50 cycles per second. One nickel and one iron wire were tested. The nickel wire was a No. 16, s.w.g., of simple rigidity 790×10^6 gm./cm.^{2}, the load on the lower end being 1.5×10^5 gm./cm.^{2}. The magnetic field in the solenoid surrounding the wire was 20 c.g.s. units, and a current of 1 amp. was sent through the wire. It was found that the maximum fatigue due to a transverse alternating magnetic field is about 8.5 per cent less than that due to a longitudinal alternating magnetic field, and that it takes about double the time to attain that maximum. The iron wire tested was a No. 16 s.w.g. of simple rigidity 810×10^6 gm./cm.^{2}, the longitudinal load on the lower end being 10^5 gm./cm.^{2} The magnetic field in the solenoid surrounding the wire was 2.5 c.g.s. units, and the current through the wire tested was 1 amp. In the case of iron wire the maximum fatigue due to transverse alternating magnetic fields is about 25 per cent less than the maximum obtained with longitudinal alternating magnetic fields of the same strength, and it takes about twice as long to attain the maximum. Experiment indicates that what is called fatigue and is measured by the magnetic twisting of the wire is not accompanied by any effect on the resistance.—*Royal Dublin Society Proceedings*, Vol. XV, page 163, January, 1917; abstracted in *Science Abstracts A*, Feb. 26, 1917.

Electrical Applications

Electricity for Enameling and Japanning.—WERT S. SCOTT.—How electric heating of enameling and japanning ovens reduces fire hazards and improves quality of product. The type of equipment and method of installation best suited to this service are also discussed.—*Electric Journal*, May, 1917.

Electric Vehicle as a Central-Station Load.—C. A. ROHR.—Among desirable features of an electric-vehicle load are that it may be made off-peak, and that is, has a high load factor, 30 to 35 per cent compared with 10 per cent for motors. The author favors the car-mile system of electric-service charges and suggests that rates be offered by power companies for every standard battery in any standard vehicle, instead of only for certain makes of batteries.—*General Electric Review*, May, 1917.

Units, Measurements and Instruments

Chromium-Steel Magnets.—E. GUMLICH.—A preliminary account of an investigation carried out at the German Reichsanstalt, the object of which was to investigate the suitability of chromium steels for permanent magnets. While tungsten steels have been used for such purposes in the past, the scarcity of tungsten due to the present war has suggested a substitute. Numbers are given for five bars of chromium steel 22 cm. by 0.6 cm., these being compared with other five bars made of tungsten steel, the product of remanence and coercive force being taken as a criterion of quality. The remanence of the chrome-steel bars was further tested under twenty hours' heating at 100 deg. C., six heatings up to 100 deg., and twenty falls from a height of 2½ m. onto a wooden block. Details of analysis and hardening temperatures are withheld. It is concluded that carefully prepared chromium steel is a suitable substitute for tungsten steel.—From *Elek. Zeit.*, Nov. 2, 1916; abstracted in *Science Abstracts*, Section B, March 31, 1917.

Roentgen Rays from Sources Other Than the Focal Spot in Tubes of the Pure Electron Discharge Type.—W. D. COOLIDGE and C. N. MOORE.—An article illustrated by many diagrams giving a description of tests which were undertaken to determine the source and amount of extraneous radiations from the electrodes of the Coolidge X-ray tube, and to what extent these radiations affect roentgenograms of the human body. Roentgenograms of the target of tubes in which different methods of screening the extraneous rays are employed are shown, and in most cases the target of the standard tube, made under identical conditions, is also shown for comparison. The conclusion arrived at is that if the shortest exposure consistent with satisfactory density of image is employed, the special tubes show no particular advantage over the standard tubes. With the present roentgenographic technique the use of other but the present standard type of tube is, therefore, not thought to be warranted.—*General Electric Review*, April, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

BILL TO LICENSE USE OF ENEMY-OWNED PATENTS

Introduced in House of Representatives, It Would Give Rights to American Citizens Under Federal Trade Commission License

A bill introduced recently in the House of Representatives, Bill No. 4704, proposes that the Federal Trade Commission license American citizens under enemy-owned patents, with ample provision giving to the owners of the patents the right of recovery of a reasonable royalty to be fixed by the court in a suit in equity to be brought at any time within one year after the close of the war and requiring a deposit of 5 per cent as security.

This is simply a limited compulsory license bill applicable to enemy-owned patents.

POWER CONTRACT REVISED TO MEET EXIGENCY IN COAL

Edison Electric Illuminating Company of Brockton, Mass., Drafts New Form, with Increase or Decrease, as Coal Moves

The Edison Electric Illuminating Company of Brockton, Mass., has joined the ranks of New England central stations which have been obliged to recognize the rising cost of fuel in power rates. It has drawn up a new form of power contract in which a comprehensive coal clause provides for coal cost fluctuations.

The clause states that whenever during the continuance of the contract the cost to the company of Pocahontas, New River or other coal of equivalent grade, of approximately 14,800 B.t.u. per pound dry, is more than $5 per ton of 2240 lb. (this cost to include delivery in the company's storage and to be the average price for all coal carried in this storage, together with coal received from time to time) during any period exceeding three consecutive months, then for each 5 cents' increase in cost over and above $5 per gross ton the purchaser will pay an additional amount of $0.00006 for each kilowatt-hour of electrical energy used during those three months and during the period that the cost of coal exceeds $5 per gross ton.

Whenever the cost to the company is less than $4.25 per gross ton as above, the price of energy will be reduced $0.00006 per kilowatt-hour for every 5 cents' decrease below $4.25 per ton. If the quality of the coal differs from that above specified, the average cost of coal determined as above is to be corrected to an equivalent of 14,800 B.t.u. per pound dry.

Coal Clause

Whenever during the continuance of this agreement the cost to the Power Company of Pocahontas, New River or other coal of equivalent grade of approximately 14,800 B. T. U. per pound dry, is more than $5.00 per ton of 2240 pounds (this cost to include delivery in the Power Company's storage and to be the average price for all coal carried in said storage, together with coal received from time to time) for any period exceeding three consecutive months, then for each five cents increase in cost over and above $5.00 per gross ton, the Purchaser will pay an additional amount of $0.00006 for each kilowatt hour of electric energy used during said three months and during the period that said cost of coal exceeds $5.00 per gross ton.

Whenever during the continuance of this agreement the cost to the Power Company of Pocahontas, New River or other coal of equivalent grade of approximately 14,800 B. T. U. per pound dry is less than $4.25 per ton of 2240 pounds (this price to include delivery in the Power Company's storage and to be the average price for all coal carried in said storage, together with coal received from time to time) for any period exceeding three consecutive months, then for each five cents decrease in cost below $4.25 per ton, the Power Company will reduce its price $0.00006 for each kilowatt hour of electric energy used during the said three months and during the period that said cost of coal is less than $4.25 per gross ton.

If the quality of the coal purchased by the Power Company differs from that above specified, the average cost of coal determined as aforesaid shall be corrected to an equivalent of 14,800 B. T. U. per pound dry.

HOW THE COAL SITUATION IS PROVIDED FOR

INDIANA COMMERCIAL MEN ARE TO DISCUSS WAR AND BUSINESS

Program of Meeting for June 20 Shows Also Papers on Organization, Increasing Load Factor on Existing Lines and Appliances

"War Times and the Central Station Business" will be the topic on which F. S. Hunting, general manager Fort Wayne (Ind.) works of the General Electric Company, will address commercial men of the Indiana Electric Light Association at Fort Wayne on June 20.

Thomas Donahue of Lafayette will present a paper entitled "Organization of New-Business Departments," which will be discussed by S. T. Sharp, Evansville; C. B. Young, Rochester; Samuel Mott, Noblesville, and P. C. Pfenning, Indianapolis.

The paper on "Increasing Load Factor of Existing Lines," by N. A. Perry of Indianapolis, will be discussed by M. S. Caldwell, South Bend; E. S. Goodrich, Winchester; C. M. Poor, Clinton, and C. A. Nash, Lafayette.

Discussion of a paper on "Development of the Sale of Socket Appliances," by Milton Hennoch, East Pittsburgh, Pa., will be led by H. C. Goldbrick, Chicago; W. H. Crawford, Hammond, and M. V. Stagg, Fort Wayne.

The association will probably hold a one-day convention in July instead of the usual three-day session in September.

WAR CONFERENCE FOR NEW ENGLAND SECTION

Proposed September Annual Convention Will Be Abandoned, but Discussion on War Problems Will Be Substituted

At a meeting of the executive committee of the New England Section of the National Electric Light Association it was voted, on account of war conditions, to cancel the ninth annual convention, scheduled to be held at New London, Conn., on Sept. 11-14, 1917. A meeting in Boston is planned, but the date has not yet been determined. The meeting will be in the nature of a war conference on important problems.

HYDRO-ELECTRIC COMMISSION BUYS ONTARIO POWER COMPANY

Canadian Body Buys Physical Assets and Power Contracts of Property at Niagara Falls, Ont.—Control Passes on Aug. 1

The Hydro-Electric Power Commission of Ontario has acquired the assets of the Ontario Power Company of Niagara Falls, Ontario.

It is stated that the company agrees to deliver its Canadian properties, including physical assets and power contracts, on Aug. 1, and that the commission is to issue $8,000,000 of its debentures for the $10,000,000 stock of the company and to assume the bonds of $14,690,000 secured by first mortgage on the property.

The commission states that municipalities will receive power at $9 per horsepower-year and estimates that the plant will pay for itself in twenty-five years.

SOUTHERN CALIFORNIA CONSOLIDATION APPROVED

Commission Authorizes Southern California Edison Company to Acquire Pacific Light & Power Corporation Properties

The Railroad Commission has rendered a decision authorizing the Southern California Edison Company to acquire the properties of the Pacific Light & Power Corporation and the control of the Ventura Power Company.

ORGANIZATION OF NEW COMPANY

The new organization follows:

Board of Directors—John B. Miller, H. E. Huntington, W. A. Brackenridge, Albert W. Harris, W. E. Dunn, George I. Cochran, J. C. Drake, William R. Staats, Arthur H. Fleming, Henry M. Robinson, J. H. Fisher and Howard E. Huntington.

Officers—John B. Miller, president; W. A. Brackenridge, vice-president and general manager; R. H. Ballard, vice-president and assistant general manager. George C. Ward, George I. Cochran, J. C. Drake and William R. Staats, vice-presidents; H. H. Trowbridge, general counsel; S. M. Kennedy, general agent; A. N. Kemp, comptroller; W. L. Percey, treasurer; A. E. Morphy, secretary; B. F. Pearson, general superintendent of the southern division; E. R. Davis, general superintendent of the northern division; John Otto, purchasing agent; D. M. Trott, assistant comptroller; B. T. Story, assistant treasurer; C. P. Staal, auditor.

The Edison company for $4,000,000 cash and $12,029,900 par value of second preferred 5 per cent cumulative non-participating stock is authorized to purchase:

Second preferred stock of Pacific Light & Power Corporation	$9,660,200
Common stock of Pacific Light & Power Corporation	10,468,500
First and refunding bonds of Pacific Light & Power Corporation	5,000,000
Notes and accounts of Pacific Light & Power Corporation	1,096,048
Preferred stock of Ventura Power Company	341,750
Common stock of Ventura Power Company	704,500

The Edison company is also authorized to purchase all of the properties and franchises of the Pacific Light & Power Corporation, and issue in exchange therefor $11,421,800 par value of its common stock. The properties are acquired subject to outstanding bonds.

The Edison company will acquire all of the stock of the Pacific Light & Power Corporation except $382,500 first preferred, $314,800 second preferred and $91,000 common. Of the Ventura County Power Company's stock, it will acquire all but $9,030 par value of preferred and $1,560 par value of the common.

The Pacific Light & Power Corporation and the Southern California Edison Company, through A. R. Kelley and George L. Hoxie, engineers, claimed an investment cost of their properties as follows: Southern California Edison Company as at present, $30,311,328; Pacific Light & Power Corporation as at present, $32,921,392; both companies as at present, $63,232,721; both companies consolidated, $63,547,522. The difference between the investment cost of the property as at present and after consolidation, amounting to $314,800, represents the value placed upon the stock of the Ventura Power Company which the Edison company proposes to acquire.

Richard Sachse, chief engineer for the commission, without making a detailed examination of the properties of the Pacific Light & Power Corporation, estimates reproduction cost of the combined properties as of Oct. 31, 1916, at $54,018,235, and the reproduction cost less depreciation at $45,266,386. The capitalization of the companies prior to and after consolidation is shown in the following table:

	Bonds and Debt	Stock Outstanding	Total Capitalization and Debt
Southern California Edison Co.	$19,843,101	$14,405,500	$34,248,601
Pacific Light & Power Corp.	25,573,996	25,534,500	51,108,496
Both, as at present	45,417,097	39,940,000	85,357,097
Both, as proposed	44,321,049	27,020,572	71,341,621
Difference between No. 3 and No. 4	1,096,048	12,919,428	14,015,476

Combined net earnings of the Pacific Light & Power Corporation and the Southern California Edison Company for the calendar year 1916, after the payment of fixed charges, taxes and an ample allowance for depreciation, are reported at $1,500,969.

ELIMINATION OF ELECTRIC TAX BY SENATE COMMITTEE

Bill Is to Go Before the Senate and Then to Conference Committee, and House Provision May Be Raised Again

The Senate finance committee has agreed to eliminate from the war revenue bill the provision in the House measure which would create a tax upon electricity. Senator Simmons, chairman of the committee, stated to a representative of the ELECTRICAL WORLD on Wednesday evening of the present week that he does not know what the Senate will do with regard to the striking out of the electricity tax when the measure comes on the floor for decision. It is possible, the chairman of the committee says, that other Senators will move to restore to the Senate bill the provision of the House measure.

It is doubtful whether the question of a proposed electricity tax will be settled short of a conference between the upper and lower houses. It is not yet settled whether there will be three or five conferees on the part of the Senate. In case there are five conferees on the part of the Senate, the chairman of the committee stated in Washington on Wednesday night, they will consist of Senator Simmons, Senator Stone, Senator Williams, Senator Penrose and Senator Lodge.

There is usually an agreement among Senators and Representatives to do a little "swapping."

Helping to Sell the Liberty Loan

Companies in Different Branches of the Electrical Industry Using Their Resources Freely to Aid the Government Financing Program

MANY of the smaller electrical companies as well as the larger properties are contributing effectively to the success of the Liberty Loan. Reports to the ELECTRICAL WORLD from all sections of the country continue to show that many plans are being executed to promote company and individual subscription and general public interest in the government financing program.

WAGNER URGES ACTION

President Herbert A. Wagner of the National Electric Light Association sends the following to member companies:

"Public service companies, by reason of their broad and close touch with a very large proportion of the population in the districts which they serve and through their large number of employees, are in a position to exercise leadership in public welfare and patriotic movements. In the present emergency it is incumbent upon them to do all in their power, by action and example, to assist the government in its plans to prosecute the war.

"The success or failure of this loan must be determined by June 15. There is no time to lose. Your local banks would, no doubt, assist you in financing the aggregate subscription. In order to take care of carrying costs the company may, if it chooses, detach one or two six months' coupons from each bond before delivery to employees."

PLANS OF DIFFERENT COMPANIES

Arrangements are being made by managers of each of the local companies operated by the W. S. Barstow Management Association for active co-operation in the work of placing the Liberty Loan. Practically the same method of organization is being followed in each locality.

The Penn Central Light & Power Company, Altoona, Pa., has announced that an allotment of Liberty Loan bonds as subscribed by employees will be purchased by the company and distributed to the men on a time-payment plan.

A large electric torch, adopted by the employees of Thomas A. Edison, Inc., and affiliated companies, West Orange, N. J., as the emblem of the Edison Liberty Loan Club, has been erected on Building No. 21, in connection with an improvised thermometer to indicate the progress of subscriptions among employees. The torch is supplemented by the caption "Edison Liberty Loan Club," being erected near the large electric flag recently presented to Mr. Edison by the workers at the plant. Employees of the companies have pledged themselves to raise at least $300,000 for the Liberty bonds.

The Public Service Corporation, Newark, N. J., has issued a notice to employees of its electric, gas and traction companies urging support of the Liberty Loan bonds with the hope that every employee will be a bond buyer. The company has offered to accept subscriptions from $50 upward and take payment at the rate of $1 per week or $5 per month, for weekly and monthly employees respectively. The payments are to be due on regular pay days.

HENRY L. DOHERTY FINANCES FLYING TOUR

Ruth Law started from Cleveland on the morning of June 5 on a ten days' flying tour in behalf of the Liberty Loan. She will drop paper bombs over the cities of the Middle West and Southwest.

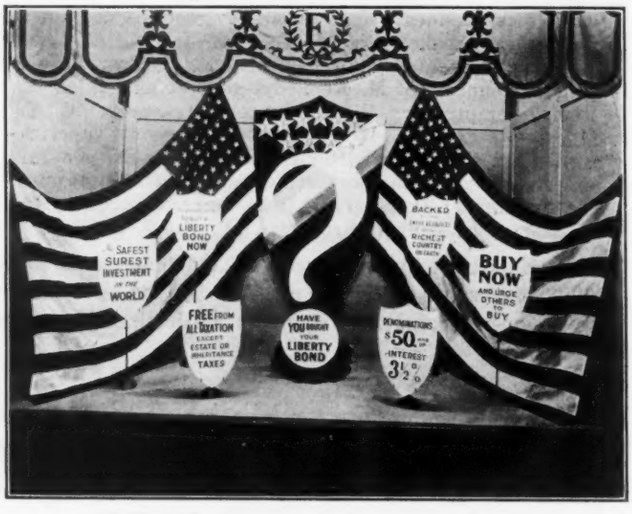
Henry L. Doherty offered to defray the expense, which Miss Law could not personally afford, and placed his entire organization at the disposal of the director of publicity of the Liberty Loan to arrange landing and supply stations.

WINDOW DISPLAYS WILL HELP

The illustration shows a way in which every central station and dealer can "get behind the government" and aid the final drive for the Liberty Loan.

The large shield against the background is cut from corrugated board and covered with blue sateen or cardboard. Across this is a band of red, white and blue paper or ribbon. In the upper section stars are lettered "L-i-b-e-r-t-y L-o-a-n."

Directly in front of the shield is a large question


SAFEST SUREST INVESTMENT IN THE WORLD
LIBERTY BOND NOW
FREE FROM ALL TAXATION EXCEPT ESTATE OR INHERITANCE TAXES
HAVE YOU BOUGHT YOUR LIBERTY BOND
BACKED
BUY NOW AND URGE OTHERS TO BUY
DENOMINATIONS $50 UP
INTEREST 3½ %

THE USE OF WINDOW DISPLAYS IS SUGGESTED

mark 4 ft. high cut from cardboard and hung from the ceiling with fine wire. It is lettered "Have *you* bought your Liberty bond?"

Shield-shaped cards of white lettered in red and blue are inscribed: "It's your patriotic duty to buy a Liberty bond now." "The safest, surest investment in the world." "Free from all taxation except estate or

inheritance taxes." "Backed by the entire resources of the richest country on earth." "Denominations, $50 and up. Interest, 3½ per cent." "Buy now and urge others to buy."

Flags are draped from the background out to the front corners. Liberty bond posters can be obtained from local banks. Making a display of this kind to-day may be the means of adding a few more thousands to the subscription total of your city.

BONDS OFFERED TO CUSTOMERS BY COMMONWEALTH EDISON COMPANY

The Commonwealth Edison Company of Chicago has purchased $1,000,000 of Liberty Loan bonds and is offering customers as well as employees an opportunity to subscribe. When a customer purchases an electrical appliance from the company's electric shop he may also include in the purchase a Liberty Loan bond. The entire amount is paid on a deferred-payment plan in which 20 per cent is paid down and the balance is paid in eight monthly payments of 10 per cent of the original amount. Interest at 3½ per cent is allowed on the payments from the time at which they are made. An interest adjustment is made at the time of the last payment.

Dividend coupons are also a feature of this offer, double coupons being given on initial payments and single coupons on the remainder. These coupons are redeemable in the electric shops of the company for electrical appliances and are worth from 2 to 4 cents on the dollar.

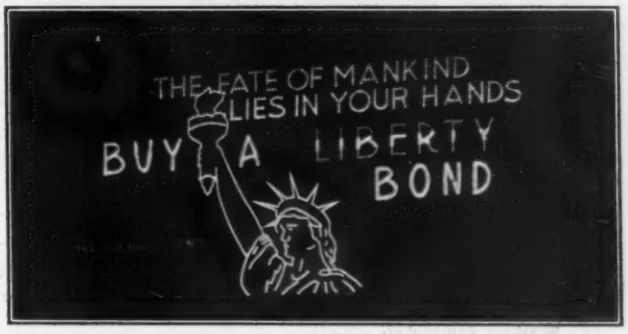
AN EASY WAY TO BUY A LIBERTY BOND
FOR THE ACCOMODATION of our patrons who may be contemplating any purchases of Electrical Appliances from us, between now and June 15th, on our Time Payment Basis of 20% at the time of purchase and the balance in eight monthly payments, we will, if desired, include a LIBERTY BOND in the purchase, the payment for it to be on time in the same way as the balance of the purchase
PAYABLE IN 9 MONTHLY PAYMENTS
We will also give DOUBLE FEDERAL COUPONS with the initial payment and the customary coupons on the subsequent monthly payments, on both the appliance and the bond. Interest will be allowed on payments on the bond at the rate which the bond bears, and will be adjusted upon delivery of the bond when the last payment is made
COMMONWEALTH EDISON COMPANY
ELECTRIC SHOP
72 WEST ADAMS STREET
ELECTRIC SHOP
MICHIGAN AND JACKSON
AUSTIN: 5646 W. Lake St.
BROADWAY: 4523 Broadway
LOGAN SQUARE: 3127 Logan Blvd.
SOUTH CHICAGO: 9163 South Chicago Ave.
ALL 'PHONES: RANDOLPH 1280

USING THE ELECTRIC SHOP

GUDE COMPANY FURNISHES WHITE WAY SIGN

The O. J. Gude Company, New York, gave a large electric sign, erected in the Times Square district at Forty-third Street and Seventh Avenue, New York. This was erected for the government free of all expense.

The original plan was to erect an exceptionally artistic sign, but the time was too short so that R. W. Woolley, director of publicity of the Treasury Department, suggested the design as used. The phrase



THE ELECTRIC SIGN IS A GREAT ADVERTISEMENT

"The Fate of Mankind Lies in Your Hands" is his thought.

There are 3800 lamps in the sign, and the structure is 50 ft. (15 m.) high and 125 ft. (37.5 m.) long.

SECTION OFFICIALS OF ASSOCIATED MANUFACTURERS

Several Sections, Meeting in New York This Week, Elect Officers to Act During the Coming Year

At meetings of sections of the Associated Manufacturers of Electrical Supplies, held at the headquarters in New York during the present week, officers were elected as follows:

Snap Switch Section—E. Whitmore, Manhattan Electrical Supply Company, elected chairman; F. E. Watts, Hart Manufacturing Company, re-elected secretary; J. C. Dallam, General Electric Company, re-elected treasurer.

Knife Switch Section—J. H. Trumbull, Trumbull Electric Manufacturing Company, re-elected chairman; T. A. McDowell re-elected secretary, W. T. Pringle re-elected treasurer.

Lamp Receptacle and Socket Section—W. D. Steele, Benjamin Electric Manufacturing Company, elected chairman; C. P. LaShelle, W. R. Ostrander & Company, re-elected secretary; F. H. Chapman, Yost Electric Manufacturing Company, elected treasurer.

Molded or Formed Insulation Section—The election of officers was postponed until the next meeting.

OHIO ASSOCIATION ABANDONS ANNUAL CONVENTION PLAN

All Activities of the Organization, However, Will Be Continued in Full Force During the Year

The executive committee of the Ohio Electric Light Association, meeting in Cleveland on June 1, decided in view of the existing war conditions to cancel the date of the annual convention at Cedar Point in July and not to hold a convention in 1917. This action was taken after very careful consideration, and excepting for canceling the annual convention all activities of the association will be continued in full force and vigor during the coming year.

ELECTRICAL CONTRACTORS FORM A POLICY CONFERENCE CLUB

Organization Is to Improve Status of the Business and Stabilize the Electrical Contracting Industry as a Whole

An organization has been formed by some of the larger electrical contractors to improve the status of their business and to serve, so far as is possible, as a stabilizer for the electrical contracting industry generally. The movement is not opposed to existing organizations or to any electrical contracting interest, large or small. It has been started by the larger companies whose interests have become interstate in character to provide a means for discussion of common problems. The meetings will be informal and to a large extent social in nature. A number of cities are represented in the membership, including New York, Chicago, Boston, Philadelphia, St. Louis, San Francisco, Los Angeles and Indianapolis.

The title selected, "the Conference Club," really indicates the purpose of the organization, although the objects are to be set forth specifically by a committee appointed at the last meeting, held at French Lick Springs, Ind., on May 21 and 23.

To accomplish more effectually the general purpose of the organization, executives of the manufacturing companies, jobbers, consulting engineers and others associated with the electrical industry are to be welcomed at the meetings. It is the plan to encourage their attendance for the discussion of policies affecting the relations of the electrical contractor with other branches of the industry.

ELECTRICAL CONTRACTING INDUSTRY IN WAR

At the French Lick Springs meeting a special committee was appointed to consider the relations of the electrical contracting industry as a whole to the war situation, that is to say, to the subject of handling either direct or indirect work for the government. This committee was directed to go to Washington to meet the authorities. It is composed of J. G. Livingston, W. Creighton Peet, F. E. Newbery, F. W. Lord, L. K. Comstock, Ernest Freeman, G. M. Sanborn and T. B. Curtis.

Another committee which was appointed at the same meeting will consider the position of the electrical contractor with respect to national advertising and publicity campaigns affecting the electrical industry as a whole. It has been suggested that the business of the contractor could be included in some effective way in such campaigns, which directly or indirectly touch the service of all of the different elements of the industry.

Speakers at the French Lick Springs meeting were W. L. Goodwin, General Electric Company, and J. Nelson Shreve, Electric Cable Company.

Previous meetings of the club were held at Hot Springs, Va., on Nov. 16 to 18, 1916; Chicago Beach Hotel, Chicago, Dec. 20 and 21, 1916, and Hotel Traymore, Atlantic City, Feb. 13 to 15, 1917.

At the organization meeting, held at Hot Springs, the object was set forth as the formulation of a plan for closer co-operation among the so-called interstate contractors for the general uplift of the business and united action in the solution of the many problems which are of mutual and peculiar interest. It was presented more in detail as follows:

"There is much to be done by us collectively in raising the standard of our work, our trade, our profession. No calling requires greater skill than ours, and yet we are regarded as mediocre; no trade in the building business is more important, yet we are regarded with a fine degree of that tolerance accorded an unremovable nuisance; no profession is more honorable, yet we are reviled as thieves and robbers; no trade is more indispensable, and yet those who employ us would have it appear that we deal in fancy goods and frivolities.

CO-OPERATIVE COMPETITION

"Price fixing used to be the order of the day and the principal function of trade organizations. It has never been very successful, except in isolated cases. It is not founded on sound, economic principles and has recently many times been declared illegal by the courts. We should not be interested in and should discountenance any attempts at price fixing.

"Co-operation in competition should rest on a firmer foundation. In a relatively small body like this the bottom of that foundation should be acquaintance with one another, an understanding through social intercourse of one another's motives and ambitions, and an appraisement at something like its true value of the power of each one to work for the good of all. Respect for the good will each has been able to establish for himself will go far toward the establishment of co-operation. Exchange of views on questions of management, organization, financing, selling, advertising, credits, forms of contracts, collections, proper volume of business, overhead expense, and its relation to price quotation, all make for intelligent co-operation.

"There is no thought expressed here, or implied, of criticism of the national association, nor is there any desire to accomplish anything contrary to the aims or ambitions of the national; there is no reason why the two organizations should not work along side by side. The thoughts suggested here are questions which occur to the interstate contractor, and the great majority of the national association does not come within this category. The national association can never raise these questions and settle them, because by making such an attempt it would be trying to legislate for a large class of its membership not in the least interested and not capable of being interested, because they choose to operate in restricted areas."

In connection with the Chicago meeting an address was heard by Arthur J. Eddy, originator of the so-called "open price" plan.

ORGANIZATION AND MEMBERSHIP

Organization of the club has been effected by the election of L. K. Comstock, New York, as permanent chairman and W. Creighton Peet as secretary. The membership, as represented at the French Lick Springs meeting, follows:

Lord Electric Company, New York and Boston—F. W. Lord, T. B. Curtis.

Hatfield Electric Company, Indianapolis—T. B. Hatfield.

Sanborn Electric Company, Indianapolis—G. A. Sanborn.

Johnston Livingston Company, New York—J. G. Livingston.

F. E. Newbery Electric Company, Chicago, St. Louis and San Francisco—F. E. Newbery, B. H. Bendheim.

L. K. Comstock & Company, New York and Chicago—L. K. Comstock, E. E. Van Cleef, G. E. Stewart.

Peet & Powers, New York—W. Creighton Peet.
United Electric Construction Company, Chicago—William F. McGuineas.
White City Electric Company, Chicago—W. B. Akeley.
Schulman Electric Company, Chicago—A. S. Schulman.
Freeman-Sweet Electric Company, Chicago—Ernest Freeman.
William A. Corrao Electric Company, St. Louis—E. P. Allison.

E. J. Ellis and Wilson McCandless of the United Electric Construction Company, Philadelphia, were unable to attend the French Lick Springs meeting.

SECRETARY LANE SAYS: "USE WATER POWER; SAVE FUEL"

Immediate and Necessary Conservation of Fuel Can Be Accomplished Best by Using All Available Water Power

Secretary Franklin K. Lane of the Department of the Interior, in reply to a letter from the manager of an electric light and power company, made the following statement as to the policy which such companies should follow during the war in the production of electrical energy:

"The unusual demands arising from the entrance of the United States into the war and the necessities of the allied governments have made the situation in this country acute. We must not only supply large additional amounts of fuel for the manufacturing industries, including munitions of war, but we must to a certain extent furnish fuel to our allies. The stimulation of production, the regulation of distribution, and, within economic limits, the elimination of unnecessary consumption of fuel, are therefore problems of national interest and of immediate concern.

"Although it will be necessary to use the coal and oil now being produced to the highest possible advantage, it must be recognized that the requirements of the nation for energy are increasing rapidly, especially in regions of great industrial activity. Obviously, immediate conservation of fuels can best be accomplished by utilizing all available water power. New requirements for power should therefore be met so far as practicable by the installation or enlargement of hydroelectric plants; present requirements should be satisfied by substituting all available water power for steam-generated energy requiring coal and oil for its production. This means that all water available at water-power plants should be made to produce energy up to the practicable hydraulic capacity of the works and the requirements of the population and industries within transmission distance of the site. In regions where water power can be made available steam-power plants should be operated only to carry loads in excess of those that can be carried by water-power plants. In my opinion this course should, under existing conditions, be followed by all power companies, regardless of the fact that at the moment it may cheaper for the company to produce steam power."

Michigan Convention Abandoned

The Michigan Section of the National Electric Light Association has abandoned its 1917 convention.

I. E. S. POPULAR LECTURE ON STORE LIGHTING IS READY

Manuscript Is Accompanied by Lantern Slides Illustrating Actual Lighting Equipments—"Home Lighting" to Follow

The Illuminating Engineering Society announces that the popular lecture on store lighting is now ready for delivery to those who wish to present this phase of the art and science of lighting. The lecture is designed to fit the need of any one who is called upon to present the principles and advantages involved.

The manuscript covers twenty typewritten pages and is accompanied by sixty lantern slides illustrating actual lighting equipments and diagrams of various types of lamps, globes, shades, reflectors and fixtures.

It is expected that there will be a demand for this lecture among proprietors, managers, decorators and others convinced of the importance of correct illumination. The lecture is well adapted for presentation before salesmen, fixture manufacturers and those who manufacture and distribute lighting accessories. Still another field is that of municipal authorities.

The lecture may be reserved for presentation upon application to the Illuminating Engineering Society, 29 West Thirty-ninth Street, New York. A number of advance reservations already have been made. The society provides the lecture and slides at a nominal service charge for maintenance and postage.

Another lecture, on home lighting, will be available within a short time, while the committee on popular lectures is actively engaged in the completion of lectures on other phases of illumination.

WASHINGTON CONFERENCE OF BUSINESS PAPER EDITORS

Government Authorities Address Representatives of Technical and Trade Papers on Questions of National Organization

Editorial representatives of business papers, in a conference at the New Willard Hotel, Washington, on May 25, were addressed by the following:

George Creel, chairman committee on public information.
Francis S. Peabody, chairman Fuel Board, Council of National Defense.
Dr. R. A. Pearson, president Iowa State College.
Franklin K. Lane, Secretary of Interior.
Newton D. Baker, Secretary of War.
Josephus Daniels, Secretary of Navy.
William C. Redfield, Secretary of Commerce.
Frank A. Vanderlip, President National City Bank, New York.
William B. Wilson, Secretary of Labor.
Van H. Manning, Director Bureau of Mines.
Herbert C. Hoover, Food Administrator.
Walter S. Gifford, Director Council of National Defense.
Frank Scott, Chairman Munitions Board, Council of National Defense.
Dr. Franklin H. Martin, in charge of Red Cross Work, Council of National Defense.
Howard Elliott, railroad executive committee, Council of National Defense.
George Otis Smith, director Geological Survey.
R. W. Woolley, director of publicity, Liberty Loan of 1917.

Among those who attended were representatives of papers of the McGraw-Hill Publishing Company, Inc.

FLOODLIGHTING STATUES IN LINCOLN PARK, CHICAGO

Figures of Civil War Heroes Illuminated for First Time on Evening Before Registration for Selective Service

The great bronze statues of Lincoln and Grant at Lincoln Park, Chicago, were lighted for the first time on the evening of June 4. The lighted statue of Lincoln

PRESIDENT LINCOLN

is visible at night for more than a mile. Four 1000-watt projectors supply the illumination. They are mounted in pairs just below the globes on the concrete lighting standards, which were already in place along a

GENERAL GRANT

drive running about 100 ft. (30 m.) in front of the statue.

The statue of Grant, astride a mammoth bronze war horse, occupies a high pedestal set on a hill. The lighting presented a problem, as the seven 1000-watt projectors had to be mounted below on the pedestal at distances ranging from 15 ft. to 25 ft. (4.5 m. to 7.5 m.) from the figure.

The lamp equipment for this work, which was undertaken as a patriotic step, was supplied gratis by the American Lighting Company. The electrical department of Lincoln Park did the wiring, supplied transformers and furnished the energy. The 2300-volt circuits, placed underground, are laid out so that they can be utilized in the future as part of the park's driveway lighting system.

A. I. E. E. PROGRAM FOR THE SPECIAL NEW YORK MEETING

Five Sessions to Be Held on June 27 and 28—Formal Introduction of the President-Elect, E. W. Rice, Jr.

As announced previously in the ELECTRICAL WORLD, the board of directors of the American Institute of Electrical Engineers voted at its last meeting to hold a special Institute meeting in New York on June 27 and 28, for the presentation and discussion of papers that were to have been presented at the annual convention, which has been canceled.

The meetings and papers committee has arranged for five technical sessions, which will be in the morning and afternoon of each day and on Wednesday evening.

The monthly meeting of the board of directors will be held Wednesday afternoon at 4.30 o'clock. The program is as follows:

FIRST SESSION, WEDNESDAY, JUNE 27, 10.30 A. M.

Subject, "High-Tension Cables."—"Problems in Operation and Maintenance of Underground Cables," by John L. Harper; "High-Tension Cable Joints," by D. W. Roper; "The Influence of Dielectric Losses on the Rating of High-Tension Underground Cables," by A. F. Bang and H. C. Louis; "Insulation Characteristics of High-Voltage Cables," by W. S. Clark and G. B. Shanklin.

SECOND SESSION, WEDNESDAY, JUNE 27, 2 P. M.

Subject, "High-Tension Insulators."—"The Insulator Situation," by W. D. Peaslee; "Expansion Effects as a Cause of Deterioration in Suspension-Type Insulators," by J. A. Brundige; "Present Practice in Design and Manufacture of High-Tension Insulators," by A. O. Austin.

4.30 p. m.—Monthly meeting of the board of directors.

THIRD SESSION, WEDNESDAY, JUNE 27, 8.30 P. M.

President's annual address.
Introduction of President-elect E. W. Rice, Jr.
Reports of technical committees.

FOURTH SESSION, THURSDAY, JUNE 28, 10.30 A. M.

Subject, "Mining."—"Forms of Power Best Suited for Various Loads Encountered in the Operation of Bituminous Coal Mines," by R. L. Kingsland; "Test of a Large Mine Hoist," by R. S. Sage.

FIFTH SESSION, THURSDAY, JUNE 28, 2 P. M.

Subject, "Water Power and Heating of Electrical Machinery." — "Economical Combination of Water Power and Steam Plants and a Convenient Method of Solution," by H. S. Putnam; "Cooling of Oil-Immersed Transformer Windings After Shutdown," by V. M. Montsinger.

LIGHTING RATE INCREASED IN HARTFORD, CONN.

On Account of Higher Operating Costs, Maximum Rate Is Advanced 0.5 Cent per Kilowatt-Hour—Expansion Necessary

On account of increased operating costs the Hartford (Conn.) Electric Light Company has announced a rate increase beginning July 1, 1917, of 0.5 cent per kilowatt-hour in the maximum net price of energy for lighting. A 10 per cent increase in flat-rate lighting prices is announced. The first 1000 kw.-hr. of lighting will be billed at 8.5 cents, the first 500 kw.-hr. of power at 5 cents, and energy for heating at 3.5 cents.

Vice-president Samuel Ferguson points out in a statement that throughout its history the company has conducted its business on the basis of a large volume of sales at a small margin of profit. If coal conditions become no worse, he stated, the average price paid this year will be almost $7 per ton as compared with $3.60 in 1916. The company's business is growing rapidly and a capital increase of $1,500,000 has been voted to meet the cost of further enlargement at the Dutch Point generating station.

JOVIAN ORDER ANNOUNCES PLAN TO INSURE MEMBERS

Method by Which They May Save Money on Insurance Premiums Is Worked Out with Health and Accident Insurance Company

Since last October, when Jovian dues were increased from $2 to $4 per year, the Jovian Order has felt the need for a tangible benefit. To meet this need a new feature has been created. To get this benefit a Jovian buys his accident insurance or accident and health insurance through the Jovian central office instead of through an insurance salesman. The policies secured are identical with those issued by three of the largest accident companies. The minimum actual saving through the purchase of a policy is $13; the maximum, through the purchase of more than one policy, is $41.

This saving is made possible because the insurance is direct from the underwriter to the individual, minus agents' commissions and office detail expense. The Jovian central office is filling the place usually occupied by general agents and sub-agents and is taking care of office and collection details without charge. The company writing this insurance is the Employers' Indemnity Corporation, which is serving the National Electrical Contractors' Association members and hundreds of utility companies.

"There has always been plenty of justification for the payment of Jovian dues for those who have dipped deeply into the order's constructive influence upon the electrical industry, or for those who have taken an active part in the work of the order," said Mercury Ell C. Bennett. "Unfortunately, however, not all allow their minds to travel far enough with the general good Jovianism is doing to see that eventually, although perhaps indirectly, their full share of benefits returns to them. Hence there was the need for a tangible benefit.

"When the present plan was proposed it seemed to fill the need. There are no exemptions in Jovian policies, and no additional assessments or charges are possible.

"As an example it may be stated that the Jovian accident policy covering such risks as traveling men, clerks, executives and others not engaged in hazardous occupations may be had for $12 a year. This policy, which is regularly a twenty-five-dollar policy, provides for a payment of $5,000 for loss of life, with a twenty-five-dollar weekly indemnity for total disability and a ten-dollar weekly indemnity for partial disability."

NEW ENGLAND HYDROELECTRIC SERVICE COMES TO AID OF COAL

Many Mill Owners Are Buying Energy at Rates Above Cost of Production in Their Local Plants

The coal shortage in New England has led to unprecedented activity in hydroelectric circles. President Harriman of the New England Power Company informed a representative of the ELECTRICAL WORLD this week that many mill owners are now purchasing electrical energy at rates even above the cost of production in their local plants and that these installations are likely in many cases to become permanent. Water conditions at the hydroelectric stations of the company are favorable, and the Somerset Reservoir, which is the most important storage basin in the combined Deerfield and Connecticut River systems, is nearly as well filled as in 1916. It has not been necessary lately to purchase electricity from central stations or other organizations operating steam plants. Last week the company took a contract for the supply of 7000 kw. in steam-plant territory. In common with other power organizations it has experienced some difficulty in obtaining motors.

It is estimated that the cold weather in May increased the consumption of anthracite coal in New England by about 800,000 tons. At a hearing on Monday of this week Mr. Harriman urged the Public Service Commission of Massachusetts to approve a curtailment of passenger service on the New England steam-railroad lines in the interest of releasing rolling stock for coal transportation and military service.

The New England Power Company is in an exceptionally strong position at this time as regards flexibility of transmission system, each group of connected generating-plant facilities being tied together by a double loop of 66,000-volt lines affording unusual insurance against interruptions. Bids are now being received by the Metropolitan Water Board for the construction of a 66,000-volt tie line between the Clinton and Sudbury stations of the State. Connections with an aggregate rating of 10,000 kw. will be completed soon between the New England and Boston Edison systems via the Framingham-Southboro district.

OHIO COMPANIES ARE TO INCREASE RATES FOR POWER

Electric Subsidiaries of Cities Service Company in That State Will Increase Schedules on Account of Higher Costs

Owing to the high cost of operation, all of the Ohio electric subsidiaries of the Cities Service Company will file schedules of increases in power rates with the Ohio Public Utilities Commission. The Massillon Electric & Gas Company and the Toledo Railways & Light Company already receive higher rates on new power business.

BASE ELECTRIC RATES ON THE COST OF COAL

Effect of Variable Expenses for Fuel on Operations of Ten Plants in Cities of 3000 to 15,000 Population

John A. Porter, vice-president Light & Development Company, St. Louis, before the convention of the Missouri Public Utilities Association, said:

"It is my purpose to draw attention to the injustice that is being done both to the public and the utility by a continuance of fixed rates. If the variables in the cost of electric service cost more, the utilities suffer; if they cost less, the public suffers, and the extent of the injury is measurable by the amount prices fluctuate.

PER CENT OF FUEL COSTS TO MANUFACTURING COSTS AND GROSS EARNINGS

Year 1915. Ten Cities with Population 3000 to 15,000

Plant No.	Per Cent Coal to Manufacturing Cost	Per Cent Coal to Gross Earnings	Plant No.	Per Cent Coal to Manufacturing Cost	Per Cent Coal to Gross Earnings
1	69.0	15.4	6	60.6	20.3
2	51.9	17.2	7	52.1	17.3
3	67.3	21.2	8	64.9	29.0
4	49.7	13.4	9	56.4	31.8
5	62.5	13.2	10	45.7	13.4

Gross receipts	$378,048
Manufacturing cost	110,273
Coal costs	65,213
Manufacturing costs to gross receipts, per cent	29.2
Coal costs to gross receipts, per cent	17.2
Coal costs to manufacturing costs, per cent	59.1

By the word 'variables' I refer to such elements as coal or its substitute fuel—oil, labor, oils, repairs, taxes, maintenance and supplies of any character entering into the cost of operating a public utility.

"The importance of coal as a variable element will be clearly shown by considering the accompanying tables, which were compiled through the courtesy of operators of ten utilities with a view of showing actual conditions. The figures were provided by utilities in this and adjoining states, four of which were straight electric plants and six operating also gas, water or ice plants. Coal conditions obtaining with them are fairly representative of other small plants in cities of 3000 to 15,000 population.

"From the data above secured a calculation will show the percentage increase in manufacturing costs and the relation to gross earnings as the price of coal advances, it being assumed that all other expenses and revenues remain stationary.

"The minimum freight rate paid by any of the ten utilities above referred to is 75 cents per ton, maximum rate $2. It is well known that the Interstate Commerce Commission has tentatively agreed to an advance in freights of approximately 15 per cent, and it may be confidently assumed that this advance will be applied at an early date.

"Advances in the price of fuels are almost always accompanied by advances in nearly all lines, and a brief consideration of the above facts should warrant an effort to abandon once and for all the antiquated system of 'fixed rates' for utility service and the substitution therefor of a 'variable factor' in the rate column that will compensate somebody when prices change.

"The public should receive the advantage of reduced prices and should pay at least the amount sufficient to cover the cost of materials when they advance. Should equitable rates be provided at this time they would, of course, be based upon the present markets, but unless some automatic scheme is designed in connection with the rates that would lower them when lower markets obtain, there would be a tendency on the part of the public to anticipate the falling market and raise the rate question long before the utility can effect savings.

"The tables indicate that the amount to be added to or deducted from the gross revenues in order to realize the same return is 1.72 per cent for each 10 per cent increase for coal, if coal is the only element of advance. Since advances in coal are always accompanied by higher costs for other things entering into production, it would be necessary to make a complete analysis of all the variables, but coal is the barometer of the manufacturing costs of utilities.

PER CENT INCREASE IN MANUFACTURING COSTS, ETC., AS COAL PRICES ADVANCE, OTHER ELEMENTS STATIONARY

	Old Prices	10 Per Cent	20 Per Cent	30 Per Cent	40 Per Cent	50 Per Cent	100 Per Cent
Coal to manufacturing costs	59.1	61.4	63.4	64.9	66.9	68.5	74.3
To gross receipts	17.2	18.6	20.0	21.2	22.5	23.8	25.6
Amount increase	None	$6.521	$13.042	$19.563	$26.085	$32.606	$65.213
Per cent gross to equalize the advance in coal	None	1.72	3.44	5.16	6.90	8.62	17.2

COST F.O.B. MINES OF SCREENINGS IN SOUTHERN ILLINOIS COAL FIELDS BY YEARS

1913—April to Sept.	$0.50 to $0.75	Sept. to April, 1914..	$0.60
1914—April to Sept.	0.75 to 0.80	Sept. to April, 1915..	0.60
1915—April to Sept.	0.90 to 1.00	Sept. to April, 1916..	0.70
1916—April to Sept.	1.00 to 1.10	May prices, 1917...	1.25 to $2.00
		Future prices.....	(?)

"It would involve monthly adjustments to meet changes in present market conditions, but the period of adjustment of the variable constant of the rates should perhaps be semi-annual or annual, unless such radical and violent changes of markets should occur as to make earlier adjustment necessary. A maximum charge should be determined upon, and agreed to by the parties interested, not as to the rate but as to the condition of the markets, before any change is made in billing customers."

FRANKLIN MEDAL PRESENTATION BY THE FRANKLIN INSTITUTE

Medal Awarded to Admiral David Watson Taylor and to Prof. H. A. Lorentz, University of Leiden

Franklin Institute, Philadelphia, made the annual presentation of the Franklin medal recently.

The Franklin medal, founded in 1914 by Samuel Insull, was presented to Admiral David Watson Taylor, chief constructor, chief of the Bureau of Construction and Repair, United States Navy, and to Hendrik Antoon Lorentz, president Royal Academy of Sciences, Amsterdam, professor of mathematical physics, University of Leiden.

The award to Professor Lorentz was made in recognition of his "researches, which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate constitution of matter."

VALUE OF WATER RIGHTS AND GOING CONCERN IN CALIFORNIA

Supreme Court Upholds Decision of Railroad Commission in San Joaquin Case—Statement of President Thelen

The Supreme Court of California has sustained the order of the Railroad Commission establishing all the electric rates to be charged by the San Joaquin Light & Power Corporation. The San Joaquin corporation attacked the commission's order on the ground that insufficient allowance had been made for the values of the corporation's water rights and "going concern" value. The court sustains the commission on both points.

The court says that the evidence presented by the corporation did not justify a value for water rights higher than that allowed by the commission, which fixed the sum at the moneys actually expended by the corporation in its purchases.

The court holds that when a property is valued by the commission in a rate case as a "going concern" or business actually in operation no additional allowance need be made for "going concern" value.

The court also holds that where a public utility has repaid itself out of its earnings for development expenditures no allowance need be made by the commission in a rate case for so-called development expense.

There is no justification in the evidence, says the court, for the corporation's claim that it had been allowed a return of only 6½ per cent on fair value of its property. But, says the court, if the return allowed had been at this rate only, it would not be confiscatory and would not warrant a reversal of the order.

The commission fixed the value of the property useful or used in electric business at $10,054,540, and on this allowed 8 per cent as a fair and reasonable return. The company contended that the commission should allow $650,000 for water rights and $1,651,021 for "going concern," and that with these sums the interest on its investment would be 6½ per cent.

The opinion of the commission declares, says the decision, and the record sustains the statement, that since the development period the earnings over and above the 8 per cent standard have been sufficient to balance deficits of the development period, with interest thereon. Under these circumstances the commission was fully justified in excluding development cost as an element of going concern value.

STATEMENT OF PRESIDENT THELEN

Max Thelen, president of the Railroad Commission of California, made the following statement to the ELECTRICAL WORLD on the decision:

"The court says, as to water rights, that a public utility must prove claimed value for water rights, and that in the San Joaquin case 'no fair estimate of the value of a water right can be based upon such broad and unsupported generalizations as underlie the appellant's argument.'

"Going-concern value has been a bone of contention in a number of public utility valuations before the California commission. In more than one case very large sums have been claimed for this intangible value beyond that fixed for the property as an operating concern.

"The court's decision in the San Joaquin case effectually sets at rest all such contentions. The court makes it plain that a company serving customers is a 'going concern,' and that when a public service board fixes the amount on which the company should rightfully be allowed interest in rates as a business in operation the board has taken into full and just consideration the entity in value known as 'going concern.'

"The Supreme Court in discussing the water rights claims of the San Joaquin company says: 'These water rights are property, and the company is unquestionably entitled to have their value considered in the fixing of its rates. The Railroad Commission made an allowance for such value, based upon the cost incurred in the acquisition of these rights. The petitioner claims that a further allowance should have been made. Concededly the burden is upon the public utility, in cases of this kind, to show the existence of any value claimed by it.'

"Both these points, hitherto moot, are settled by the Supreme Court's decision. They remove from the field of claim and argument two principal sources of litigation before the Railroad Commission."

NEW STREET-LIGHTING PLANS FOR CINCINNATI

Incandescent Lighting of Increased Intensity to Replace Arc Lamps on Fourteen Miles of Streets—Total Cost $140,000

The director of public service of Cincinnati has asked for bids on the installation and maintenance of lighting equipment on thirteen streets. This will necessitate the installation of 913 new lamps and the displacement of 294 old arc lamps now being operated at a cost of $55 per year. It is estimated that the new lamps will cost about $60 a year to operate. The city will pay the cost of installations at intersections and a percentage of the cost, less the cost of intersections; the remainder is to be assessed on a front-foot basis against abutting property. It is expected that the assessment will be about 70 cents per foot. A rough estimate of the total cost is $140,000. Fourteen miles of street will be improved.

Under the specifications the lighting system shall consist of a constant-current 6.6 amp. alternating-current primary circuit with maximum pressure of 5000 volts. By means of individual transformers at each lamp this energy shall be converted for use in a secondary circuit operating at 20 amp. and approximately 14.1 volts. The transformers are to be placed in the base of the standards and are to be similar to the General Electric Company's type IL. The standards are to be placed approximately 80 ft. apart and located directly opposite each other on both sides of the street. They are to be of cast iron of a design similar to those already in use on Sixth Street, Cincinnati. They are to be of such height that the lamp filament will be approximately 13 ft. 4 in. above the surface of the sidewalk. All standards are to be painted a verde antique green. The lamps to be used will be of a 16-cp. tungsten-filament, nitrogen-filled type of 20-amp., 14.1-volt rating. Sockets of the mogul skeleton type to fit lamps with screw bases will be used. The number of lamps per circuit is limited to seventy-five. The entire underground installation is to be carried in conduits. Conductors are to be either varnished cambric or rubber-covered cables.

The contract will be dated from the time the system is placed in service and will expire on June 1, 1922.

IRON WIRE FOR RURAL LINES IN CONNECTICUT

State Public Utilities Commission Approves Petition of Central Connecticut Power & Light Company, Due to High Copper

The Connecticut Public Utilities Commission has formally approved a request of the Central Connecticut Power & Light Company to use iron wire for certain rural extensions on account of the high price of copper. Three hearings were held.

L. P. Perry, general manager of the company, said in part in his petition to the commission:

> The use of iron wire for the transmission of high-tension electric current is not specifically approved by the rules of your commission.
>
> On account of the high cost of copper wire your petitioner desires to secure approval for the use of double-galvanized iron wire in the transmission of electric current on certain of its rural distribution lines.
>
> The proposed method and details of construction of such distribution lines are as follows: Double-galvanized No. BB grade No. 6 iron wire to be used, attached to poles spaced 250 ft., sagging the wire sufficiently to give a factor of safety of two with "Class B" loading, viz., ½-in. coating of sleet on the wire and a wind pressure equaling 8 lb. per sq. ft. of exposed surface of wire and sleet, at a temperature of 0 deg. Fahr. Such iron wire to be used only where the energy to be transmitted is so small that the voltage drop will be inappreciable. Said iron wire to be replaced with copper wire if and when such iron wire depreciates to a point where it is unsafe.

In its decision the commission says:

> Most of the standard specifications for construction of electric transmission lines require the use of copper wire or wire of other non-corrosive metal, and the commission has not heretofore approved the use of iron wire for the purposes designated in this petition. Petitioner alleges, however, that under present conditions the price of copper makes it impracticable for the company to construct numerous lines in rural districts where the amount of energy to be consumed is limited. For this reason petitioner seeks approval of the use of iron wire under specifications which are claimed to provide equal safety and under which such lines can be constructed at a material saving in cost.
>
> It was stated that on account of the relatively low conductivity of iron wire as compared with copper wire it has been only in occasional instances that iron wire has been used heretofore for transmission of electric current, and the commission has no record of such form of construction being approved by a regulative body. Petitioner cited the use by the Hydro-Electric Power Commission of Ontario, Canada, of steel cable on 500-ft. spans for the transmission of current at 110,000 volts.
>
> Evidence was submitted tending to show that the objection to the use of iron or steel wire was more on account of the loss of power due to low conductivity than to any danger involved through the possibility of corrosion and consequent failure of the line. On this question of corrosion, however, there appears to be some difference of opinion among electrical authorities, some of whom are of the opinion that iron wire should not be used, except when great care is taken in inspection of lines, on account of the possibility of breakage at points of attachment to poles or at other places where deterioration is liable to be excessive. There seems to be an agreement among electrical experts that where iron wire is used the tensile strength of such wire should at least equal that of the copper wire which would ordinarily be used in the same class of construction. In the specifications outlined in the petition it is proposed to guarantee safe construction by allowing sufficient sagging of the wire to give a factor of safety of two, with so-called "Class B loading," which is described as ½-in. coating of sleet on the wires with a wind pressure equaling 8 lb. per sq. ft. of exposed surface of wire and sleet in a temperature of 0 deg. Fahr. There is no request made in this petition for approval of the use of iron wire in joint construction with other companies.

Upon consideration of all the facts shown at the hearing and upon information independently secured, the commission decided to approve the use by the company of iron wire for transmission purposes in the manner and under the specifications set forth in the petition upon certain prescribed lines.

The commission also prescribed rules for construction.

TEN YEARS' GROWTH OF THE BALTIMORE COMPANY

Consolidated Gas, Electric Light & Power Company Issues Booklet Showing Its Progress During a Decade

A ten-year review dealing with the present status and prospects of the Consolidated Gas, Electric Light & Power Company of Baltimore has been issued to shareholders, with a letter from President Herbert A. Wagner.

Electric gross and net earnings are now 57 per cent of the total business. Regarding its hydroelectric supply and steam-electric capacity the company says:

"The company is in a very fortunate position in that

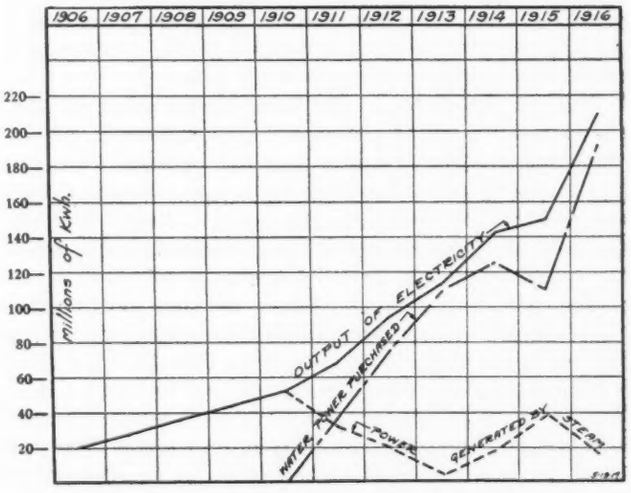


CHART SHOWING GROWTH OF BALTIMORE COMPANY

it has available under a long-term contract, at favorable rates, a great amount of the electricity generated at the hydroelectric plant of the Pennsylvania Water & Power Company. The present capacity of the water-power company is 84,000 kw. Foundations are ready for two more units, which when installed will give a total capacity of 114,000 kw. The amount of hydroelectric energy purchased by this company for the fiscal year ended June 30, 1916, was 92 per cent of its total output for the period. The company's steam generating capacity is 90,000 hp., which will be augmented by 100,000 hp. now under contract for its Westport plant, thus placing the company in a strong position with respect to electrical equipment."

Gross income from electric operations was $1,216,305 in 1906 and $4,336,240 in 1916, a gain of 256.5 per cent.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Higher Rates Ordered in Pennsylvania.—The Pennsylvania Public Service Commission ordered the Raystown Water Power Company and the Penn Central Light & Power Company, beginning June 1, to furnish electrical energy at Huntingdon and vicinity at 9 cents per kilowatt-hour with discount of from 10 to 20 per cent according to the amount used. During the past four years both companies have competed for business in this territory, with the Raystown company charging 6 cents per kilowatt-hour and the Penn Central company 3 cents.

Consolidation in New Jersey.—The Board of Public Utility Commissioners of New Jersey has granted the application of the Monmouth Lighting Company and the Middlesex & Monmouth Electric Light, Heat & Power Company to merge and consolidate. The Monmouth company operates at Freehold, Farmingdale, Englishtown and vicinity, and was formed by a consolidation of the concern of that name and the Farmingdale Lighting Company in January, 1916, with authorized capital of $500,000; the Middlesex & Monmouth company, with capitalization of $50,000, operates in the northern portion of Monmouth County from South Amboy to Freehold, where it furnishes electric energy to the Monmouth company. The board has also issued an order granting the Jersey Central Traction Company permission to transfer its power house, transmission lines and substations to the Monmouth Lighting Company for a consideration of $701,200. This authority is given in order to divorce, as far as possible, the traction from the lighting business, and upon the condition that the traction company will use the proceeds in the retirement of outstanding securities.

Competition in Pennsylvania.—The Schuylkill Electric Company has made application to the Pennsylvania Public Service Commission for approval of a ten-year contract awarded by the borough of Girardville to furnish municipal and commercial lighting. The Eastern Pennsylvania Light, Heat & Power Company has filed a protest against the proposed contract, holding that the territory, with population of about 6000 persons, does not warrant competition. In this the company sets forth: "The borough advertised for bids for street lighting in January, stipulating that the successful bidder must agree to furnish electricity for commercial purposes at a flat rate of 25 cents per month per 16-cp. light. The Eastern Pennsylvania company bid $3 a year lower on the street lighting than the Schuylkill company, and $1 lower for 100-cp. and 60-cp. incandescent lamps; moreover, such bid specified a well-known, efficient and modern type of lamp, while that of the Schuylkill company did not specify any type of lamp. The Schuylkill company was the high bidder, and, moreover, does not have any poles or wires for street lighting in the borough, and yet the Borough Council awarded the contract to such company. This action, if the Public Service Commission approves the contract, will mean a duplication of facilities and result in the borough paying more for its electric lighting than with the present facilities."

Flat-Rate Schedule in Illinois.—In the matter of proposed electric rates filed by the Lincoln Water & Light Company for Brainerd Park, the Illinois Public Utilities Commission approved a flat-rate form of schedule for electric service rendered in a situation peculiar to the case. The facts disclosed by the evidence are that the petitioner is rendering electric service to certain consumers at Brainerd Park, among which one is known as the Country Club, another is the Chautauqua Association, and there are those who possess cottages or tents at the Chautauqua grounds or in the vicinity thereof; that the locality known as Brainerd Park is between 2 and 3 miles from the city of Lincoln proper; that the locality known as the Chautauqua grounds is at or near the said Brainerd Park; that the so-called Country Club is in the same vicinity; that heretofore consumers on the Chautauqua grounds have been charged on a flat-rate basis during the approximate two weeks of the so-called Chautauqua season; that the installation of meters in tents and cottages at the Chautauqua grounds would necessitate an undue investment in meters compared to the relatively small revenue derived therefrom during the fourteen days of the Chautauqua season; and that such meters would be jeopardized by the inherent risks of the installations. In justification for making a departure from its customary practice of requiring meters on all electric services, the commission calls attention to the very special circumstances which warrant the establishing of flat rates in the case of Brainerd Park. Alluding to the peculiar conditions which prevail at Chautauqua resorts, it makes this statement: "Although this commission has committed itself in the policy of requiring general meter service wherever practicable, the case here appears to be one wherein the requirement of complete meter installations is quite impracticable and unduly costly. Meters on Chautauqua services would have to be installed and taken out once every year and would be in service during fourteen days only each year. To provide meters at the tents and cottages in the Chautauqua grounds would necessitate unavoidable fixed charges, would almost double the minimum flat rate proposed herein, and would, consequently, throw a severe burden upon those consumers who desire to utilize electric service during their summer outing at the Chautauqua grounds."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Property Devoted to Public Use.—Property not yet actually devoted to a public use but purchased and held by a public service corporation in reasonable anticipation of future needs is deemed "devoted to a public use" although not actually in use, the Supreme Court of Washington held (163P.15).

Review of Commission's Orders.—The Supreme Court will not substitute its judgment for that of an administrative board as to matters within its province, and so will not interfere with an order of the Public Utilities Commission where it does not appear from the record that the action of the commission is unlawful or unreasonable, was the opinion of the Supreme Court of Ohio (114 N. E., 1036).

Rights in City Streets.—General statutory provisions authorizing telephone companies to use state highways do not give them unrestricted right to erect their apparatus in cities and villages, it was held by the Supreme Court of Michigan (161 N. W., 982). While municipalities cannot annul general statutory provisions authorizing telephone companies to use state highways, they may reasonably direct upon what streets and in what manner the lines shall be installed.

Eminent Domain.—The fact that an electric light company is a public service corporation, and that its property through which a street is to be opened is dedicated to the public purpose of supplying electric energy, does not prevent the jury, in proceedings to open a street, from determining the increased market value caused by such opening under the Baltimore City Code, requiring jury to find the market value of the remainder of the tract after the street is opened, according to the Court of Appeals of Maryland (99 A., 968).

Action for Employee's Injury.—Where defendant offered evidence that the superior of deceased ordered plaintiff to "get up on the wagon and cut the wire," it was competent for the plaintiff to prove that the wagon was not a place of safety, the Supreme Court of Pennslyvania held in Foster versus Butler County Light Company (100A. 452). On an employer's appeal from a verdict against it, in an action to recover for the death of an employee, the evidence should be viewed in the most favorable light for plaintiff, and he should receive the benefit of every reasonable inference therefrom on the question of contributory negligence. Where an employee was working under a superior who was urging haste he was not required to use the same measure of care he otherwise would have been required to exercise.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Mahoning & Shenango System Power Contracts.—The Brier Hill Steel Company has closed a contract with the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, for 10,000 hp. to operate a large new plate mill which will be constructed immediately. Within two weeks the Mahoning & Shenango System has closed power contracts for a total of 13,600 hp.

City Council of Portland, Ore., Declines to Put Purchase Proposition on Ballot.—The City Council of Portland, Ore., refused to place on the ballot at the June election the proposition of C. P. Church that the city purchase electrical energy at wholesale from the two large electric companies and distribute it among consumers, and also purchase the Home Telephone Company and operate it as a public utility.

Large Power Contracts for New York Edison Company.—Two contracts totaling an installation of 1215 hp., one of which closed down a large steam engine plant, are included in one week's work of the power bureau of the New York Edison Company, of which C. K. Nichols is in charge. One contract calls for service for an installation of 540 hp. to supplant steam equipment that has been operated for some time by the Ice Manufacturing Company. The second contract, with the Bare Wire Company, calls for 675 hp. to operate a variety of big motors to be used in the work of drawing wire. The company will use power estimated at 1000 hp. in addition to the initial installation when a huge rolling mill in finally put into operation.

Features in New Business of Lehigh Valley Company.—The Lehigh Valley Light & Power Company, Allentown, Pa., has begun work on several large power installations. A modern pumping installation is to be made for the Bethlehem City Water Company, South Bethlehem. A 900-hp. connection for the Lehigh Portland Cement Company, between Allentown and Slatington, is the first installment of a total of 12,500 hp. to be supplied eventually. Construction of the transmission line is under way. A number of silk mills in the district are abandoning steam plants and installing electric motors. The Phoenix Silk Company, Allentown, will require 600 hp. in its broad-silk plant and 200 hp. in the ribbon plant. The Lehigh Valley silk mills, South Bethlehem, will receive service for 500 hp.; the McBride Brothers' silk mill, Fullerton, 150 hp.; the Gallia silk mills, South Bethlehem, 200 hp., and the Allentown Silk Company, 600 hp. The plant of the Lehigh brick works near Allentown will have 400 hp. Plants of the National Slag Company at Hokendauqua, the Emanuel Slag Company at Catasauqua, and the Kurtz Furniture Company at Fullerton, with an aggregate of approximately 600 hp., are also being completed and will receive service soon.

Garage Men Visit Vehicle Factory.—On June 5 Harry Salvat of Chicago, owner of the Fashion electric garages and local sales agent for the Milburn electric cars, took Chicago's fifteen electric garage owners to the Milburn factory at Toledo. The trip was planned to give these men a real insight into manufacturing methods that enter into the modern electric passenger car and to imbue them with a first-hand knowledge of the Milburn organization as a whole. It is thought particularly necessary at present to have each one able conscientiously to recommend the light electric passenger car, since without this co-operation the Fashion Garage Company's new salesroom and new battery service plan (see ELECTRICAL WORLD, June 2) could not accomplish its fullest purpose.

Railway Power Contracts in New York.—The Interborough Rapid Transit Company, New York, has agreed to sell power to the New York Municipal Railway Corporation and the New York Consolidated Railroad Company for the operation of the new rapid transit lines of the Brooklyn system in Manhattan. The agreement has been approved by the New York Public Service Commission, First District. Another agreement has been approved between the Transit Development Company, New York Municipal Railway Corporation and New York Consolidated Railroad Company, all Brooklyn Rapid Transit associated companies, under which the Transit company will furnish power for all rapid transit lines in Brooklyn. Both contracts are for approximately ten years. It is estimated that the annual demands of the Brooklyn company from the Interborough company for the first year, Dec. 1, 1917, to Dec. 1, 1918, will be 49,900,000 kw.-hr. direct-current energy at 625 volts, for traction purposes. The Interborough agrees to furnish alternating-current energy of high tension at 11,000 volts for signals and lighting; estimated requirements for this are, for 1917-18, 4,235,000 kw.-hr. For the direct current the Brooklyn company will pay 8¼ mills per kilowatt-hour, delivered at the Interborough substation; the alternating current is to be furnished at 7 mills per kilowatt-hour, also at the Interborough substation. In addition, the Brooklyn company agrees to pay 23 per cent of the actual cost of installing certain minor auxiliary equipment in the Interborough substation. Provision is made for revision in the event that the demand varies from expectations or the price of coal varies from $3.23 per long ton of 2240 lb. The contract with the Transit Development Company provides that for the first six years direct-current energy shall be furnished at 1 cent per kilowatt-hour, and alternating-current energy at 9 mills per kilowatt-hour. For the last four years of the ten-year period the rate for direct current shall be 9.9 mills per kilowatt-hour and for alternating current 9 mills per kilowatt-hour. The rates shall be altered with changes in coal cost.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

The Jovian League of New York.—The Jovian League of New York will hold its annual outing at the Harlem Yacht Club, City Island, on June 19.

Engineering Club of Columbus.—S. G. McMeen, president of the Columbus (Ohio) Railway, Power & Light Company, delivered an address before the Engineering Club of that city on May 29.

Institute of Radio Engineers.—Prof. M. I. Pupin, president of the Institute of Radio Engineers, read a paper on "Iron at Radio Frequencies" at the meeting of the institute on June 7, at the Engineering Societies Building, New York City.

Engineers' Club of San Francisco.—At the weekly luncheon held by the Engineers' Club on May 24 Dr. Thomas Addison, Pacific Coast manager General Electric Company, who had just returned from the East, gave a talk on "General Impression as to War Conditions, Especially as They Affect the United States."

Cleveland Section, A. I. E. E.—At the annual meeting of the Cleveland Section of the American Institute of Electrical Engineers, held on May 21, the following officers were elected: C. M. Rakestraw, chairman; C. S. Ripley, secretary; G. N. Lindstrom, chairman of the papers committee; board of managers, L. P. Crecelius, I. H. Van Horn and R. B. Chillas, Jr.

St. Louis Jovian League.—Memorial Day addresses were the feature of the St. Louis Jovian League luncheon meeting May 29. Colin M. Self, postmaster of St. Louis, was one of the principal speakers. W. E. Billmeier, who has taken an active part in promoting the recently organized Salesmanship Club, addressed the meeting on the "Need for Closer Co-operation Between All Organizations." The officers of the league submitted a formal application to the Jovian Order for a new charter, and charter No. 20 was assigned to it.

Cleveland Electrical League.—At the annual election of the league on May 31, J. M. Bateman, Cleveland manager of the Western Electric Company, was chosen president. The board of directors are as follows: Prof. H. B. Dates, Case School of Applied Science; W. G. McKitterick, sales manager National Lamp Company; H. L. Martien, president of the Martien Electric Company; M. H. Moffett, district sales manager of the National Carbon Company; E. H. Ott, sales engineer of the Westinghouse Electric & Manufacturing Company; G. E. Rogers, manager electrical department of the Sterling & Welch Company; and Mathias Turner, assistant general manager of the Cleveland Electric Illuminating Company.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

W. J. Rose has resigned as general manager of the Alliance Gas & Electric Company, Alliance, Ohio.

Charles Y. McVey, who was recently elected president of the Ohio State Telephone Company, has resigned as president of the United States Telephone Association owing to his greatly increased duties in his new position.

Fred Sintes, superintendent of electric light and power department of the W. M. Carney Mill Company, Atmore, Ala., has resigned his position, to take effect July 1, and has accepted a position with the Texas Company, Birmingham, Ala.

C. R. Young, Portland, Ore., has been appointed sales manager of the Pacific Power & Light Company, with headquarters in Portland. Mr. Young was graduated from the Leland Stanford University in 1910, after which he became connected with the engineering department of the city of Portland. In 1911 he was appointed assistant purchasing agent of the Pacific Power Company, from which he advanced to his present position.

George W. Robinson, president of the Tri-State Telephone & Telegraph Company, St. Paul, Minn., has been elected president of the United States Independent Telephone Association to succeed Charles Y. McVey, who resigned to devote his entire attention to his new duties as president of the Ohio State Telephone Company. Mr. Robinson entered the telephone business in 1904 with the company with which he is now president. In 1910 he became vice-president and treasurer and in 1914 was elected president.

J. P. W. Brown, for the last twenty years with the lighting department of the Nashville (Tenn.) Railway & Light Company, has been promoted to the newly created position of assistant general superintendent of the company. Mr. Brown began as switchboard boy with the Cumberland Electric Light & Power Company in 1897. Two years later, when the company was merged with the Nashville Railway & Light Company, he was made superintendent of the lighting and power department, which position he has held continuously ever since. He is a graduate of the engineering department of Vanderbilt University and was the first president of the Jovian League of Nashville.

Byron T. Burt, who has been associated with the W. S. Barstow interests for the last two years as operating manager in charge of several of the properties of the General Gas & Electric Company, has accepted a position with the Mexican Light & Power Company of Mexico City as assistant to the chief executive and the receiver, to assist in the management, engineering and operation of the company, with headquarters at Mexico City. Prior to going with the Barstow interests in the spring of 1915, Mr. Burt was connected with the South American Trading Company as manager at Buenos Aires for a few months. Mr. Burt was formerly manager of the old Chattanooga Electric Company until its consolidation with the Chattanooga Railway & Light Company. When the Chattanooga & Tennessee River Power Company was organized to construct the hydroelectric plant at Hale's Bar on the Tennessee River he was made general manager, which position he held until Jan. 1, 1915, when he resigned to go to South America.

R. H. Ballard, who for some time has been secretary and assistant general manager of the Southern California Edison Company, Los Angeles, Cal., on consolidation of the company with the Pacific Light & Power Corporation, has been elevated to vice-president and assistant general manager of the company. Mr. Ballard was born at Hamilton, Ont., in 1875, and when a boy of fifteen entered the employ of the Thomson-Houston Electric Company at Chicago. In 1894 he went to Schenectady on the consolidation of the Chicago company with the General Electric Company. There he was employed in the treasury department. In 1897 he left the General Electric Company to enter the employ of the West Side Lighting Company at Los Angeles as bookkeeper. Three years later he became cashier and office manager of the Butte (Mont.) Electric & Power Company, where he remained until 1904, when he returned to Los Angeles to accept a position as auditor of the predecessor of the company he is now with, namely, the Edison Electric Company. Since then he has passed through successive stages to the position he now holds with the Southern California Edison Company. Mr. Ballard is one of the leading figures in Pacific Coast utility work and was the first president of the Pacific Coast Section of the N. E. L. A. At the recent annual convention of the National Electric Light Association he was elected second vice-president.

R. H. BALLARD

L. A. Bafford, cashier of the Pacific Power & Light Company, Toppenish, Wash., has been promoted to the position of manager for the company at Sunnyside, Wash.

W. A. Brackenridge retains his position of vice-president and general manager of the Southern California Edison Company in its consolidation with the Pacific Light & Power Corporation.

William Hodge, who for the past twelve years has been manager of the Cornwall Street Railway, Light & Power Company and the Stormont Electric Light & Power Company, Ltd., at Cornwall, Ontario, has resigned and will devote his time to consulting work on the local utility properties.

S. E. Dillon, who was elected president of the Arkansas Association of Public Utility Operators at the recent annual convention held at Pine Bluff, is general manager of the Citizens' Electric Company, Hot Springs, Ark. Mr. Dillon took charge of the management of the Hot Springs utilities in 1911.

C. V. Peeling, manager of the Oshawa (Ont.) Electric Light Company, one of the properties operated by the Hydro-Electric Power Commission of Ontario, has been appointed manager of the Cornwall Street Railway, Light & Power Company and the Stormont Electric Light & Power Company, Ltd., at Cornwall, Ont., succeeding William Hodge, resigned.

Dr. William Marconi, who is a member of the commission now visiting the United States in behalf of the Italian government to co-operate with the federal government in laying plans for the war, received on Wednesday the honorary degree of doctor of science from Columbia University in recognition of his contribution to the world's means of transmitting intelligence. Dr. Marconi was born at Griffone, near Bologna, Italy, April 25, 1874. In 1895 he made his first experiments in wireless telegraphy and put them into practical use in England in the following year. He first sent a radio message across the English Channel in 1899 and across the Atlantic in 1901. Since that time he has further perfected long-distance radio-telegraphy, the value of which is now fully recognized. For his research and accomplishment Dr. Marconi has received recognition from many governments and seats of learning. The greatest international prize that can be won by any scientist, the Nobel prize for physics, was shared by him in 1909 with Professor Braun. In 1914 he was elected a senator in the Italian Parliament. Among the various decorations bestowed on him is that of honorary knighthood of the Grand Cross of the Victorian Order.

Obituary

Arthur Gunn, president of the Wenatchee Valley Gas & Electric Company of Wenatchee, Wash., was instantly killed on May 24 when his auto overturned. Mr. Gunn had been associated with the Wenatchee Valley company since 1896, during that time serving for one session in the Legislature.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

PRESENT INDICATIONS POINT TO FAN SHORTAGE

Some Manufacturers Have Already Sold Their Entire Output of 1917 Models—Demand Dependent on Weather

At the present writing indications point to a shortage of electric fans this summer. Already there are reasons to believe that several manufacturers have sold their entire output of 1917 models. Moreover, it is known that certain manufacturers have received a number of excellent orders of late which they have had to turn down. It is, therefore, evident that even at this early date the shortage is beginning to be manifest.

So far as the manufacturers are concerned, the selling season for fans has only a few more weeks to run. Ordinarily the trade has made its purchases by July 1. This year the trade generally entered the market for fans earlier than usual. Last year was fan year, and as a result the stocks of the country were pretty well cleaned out and consequently jobbers made early contracts. Also there was some apprehension on the part of the trade as regards deliveries. It was felt that the earlier the order was placed the better chance one had of receiving stock on time.

The demand from the trade this year has been excellent, and were it not for existing industrial conditions, the business transacted would be much larger. Inability to obtain sufficient raw materials and labor shortage and instability acted in a certain measure to curtail production.

How acute the threatened fan shortage actually will become depends, of course, in large measure on the weather of the coming three months. If there is a prolonged hot, dry spell stocks will undoubtedly be insufficient. On the other hand, if a season similar to the summer of 1915 occurs, then the supply will probably be ample.

ELECTRICAL EXPORTS PASS $5,000,000 MARK IN MARCH

Total for First Quarter of Current Year Amounts to $13,638,356, Which Is at the Rate of $55,000,000 a Year

Another record for electrical exports was smashed in March, when the value of electrical merchandise shipped abroad was $5,199,163. This is the first time that the monthly exports of electrical goods have passed the five-million-dollar mark. In this foreign business the electrical trade is fast making and breaking records. It was only in September last that the four-million-dollar mark for monthly exports was first passed. March exports were more than 80 per cent greater in value than March, 1916, exports.

Exports of batteries, arc lamps, telegraph instruments and miscellaneous merchandise were larger than in any previous month. The exports of miscellaneous equipment were practically one-half the value of the entire month's trade.

For the first quarter of the current year electrical exports amounted to $13,638,356, in comparison with $8,148,238 for the corresponding period of 1916. Should the volume of business transacted during the first three months of this year be maintained during the remaining nine months, the exports for the year will total up in the neighborhood of $55,000,000.

During the nine months ended March, 1917, the value of electrical exports was $36,992,204, which is but a few million dollars less than the record total for the entire twelve months of 1916; for the nine months ended March, 1916, $21,036,098, and for the nine months ended March, 1915, $13,867,092.

While it is evident that electrical goods are being exported more freely and in greater volume than at any time previous to the war, it must not be concluded that the increase is represented truly by the figures here presented. In fact the actual increase in trade, the volume of goods sold, is much smaller than the figures would lead one to believe. The figures show values only, and since numerous increases in price have gone into effect during the last year and a half, a considerable part of the apparent increase shown in the figures is thus accounted for.

That these figures are not larger than they are is owing entirely to the swamped condition of the American factories. The foreign market for American electrical goods has been almost limitless. Domestic demand and inability to produce more than so much prevented American manufacturers from seeking foreign business as actively as otherwise might have been the case.

The accompanying figures were furnished by the Bureau of Foreign and Domestic Commerce, Washington, D. C.:

Articles	March 1916	March 1917	Nine Months Ended March 1916	Nine Months Ended March 1917
Batteries	$157,497	$380,992	$1,084,421	$2,150,150
Dynamos or generators	72,022	132,760	1,037,735	1,876,824
Fans	18,376	18,004	252,842	272,768
Insulated wire and cables	269,606	719,639	2,188,763	5,277,206
Interior wiring supplies, etc., including fixtures	69,981	80,579	698,952	776,775
Lamps:				
Arc	3,191	4,015	15,359	11,808
Carbon-filament	9,548	12,505	125,441	109,455
Metal-filament	86,894	176,577	878,973	1,224,751
Meters and other measuring instruments	63,824	99,509	571,945	781,486
Motors	473,771	572,733	3,196,582	4,174,965
Telegraph instruments (including wireless apparatus)	19,703	135,775	115,820	327,487
Telephones	180,534	151,739	734,642	1,306,847
Transformers	87,520	116,347	694,469	856,793
All other	1,372,408	2,597,989	9,440,154	17,844,889
Total	$2,884,875	$5,199,163	$21,036,098	$36,992,204

STANDARDIZATION OF CORDS AND PLUGS FOR APPLIANCES

Recommendations by N. E. L. A. Sub-committee Do Not Specify Any Particular Types for Such Equipment

Standardization of electrical equipment is constantly receiving more attention. Until recently the electrical industry was more than prolific in new devices. When the war was yet young it became more and more apparent that behind the standardization of electrical goods and products there was a well-founded economic as well as an operating reason. The manufacturers have been working as hard as possible on standardization schemes and have made remarkable progress. There has been good co-operation between the American Institute of Electrical Engineers and the manufacturers, but this has mostly been in the larger apparatus.

Quite recently a move was made by the wiring committee of the National Electric Light Association toward standardization of cords and plugs for appliances. A sub-committee on this matter, headed by Dorsey R. Smith, made the following recommendations at the recent annual convention of the association:

"That all table devices such as percolators, toaster stoves

and grills be equipped with a standard cord and plug; that the socket end and the appliance end of such cords be interchangeable; that irons and kitchen utensils such as broilers should have a standard cord and plug interchangeable for like devices; that vibrators, hair dryers and curling irons have a standard plug for the appliance end, and for the socket end the same standard plug recommended for irons and table devices."

SUPPLY OF PLATINUM APPARENTLY ADEQUATE

Census of Immediately Available Unmanufactured Stocks Now Being Taken by United States Government

A census of stocks of unmanufactured platinum in the United States that can be considered as immediately available is now being taken by the United States Geological Survey. From the information already available it would appear that there are supplies of platinum sufficient to meet such extensions of contact-process plants as may be required immediately, while still leaving a surplus for all ordinary requirements.

The available supply of platinum in the United States appears to be adequate to meet immediate needs, but it is emphasized by the Geological Survey that new demands may arise at any time which the present stocks of platinum in this country could not meet.

INCREASE IN VOLUME OF JOBBERS' STOCKS

Canvass of Eastern Supply Men Shows an Average Increase Over Normal in the Neighborhood of 40 Per Cent

Ever since the fall of 1915, when deliveries began to lengthen out, jobbers have been carrying larger stocks of electrical goods than under normal conditions. In order to find out how much, on the average, jobbing stocks had increased in volume a canvass was recently made of Eastern jobbers.

As was to be expected, this canvass showed a wide variation in the amount of additional stock jobbers are required to carry. Some jobbers have been carrying a stock just twice as large as normal, while the stocks of others are no larger to-day than they were prior to the war.

The canvass revealed, however, that on the average it has been necessary for Eastern jobbers to carry a stock in the neighborhood of 40 per cent larger in volume since the fall of 1915. It is doubtful if this figure will hold for other sections of the country. In the Far West and along the Pacific Coast, for example, there is every reason to believe that the average stock is much more than 40 per cent larger than normal. In fact, it would not be surprising if 100 per cent were much nearer the real condition in this section of the country.

The Far West is remote from the manufacturing centers of the country and has to rely almost entirely on long freight hauls for its goods. While deliveries have been so poor and railroad freight service in such a congested condition, with a large shortage in available rolling stock, Western jobbers have found deliveries so long and so uncertain that stocks had to be increased to a great extent in order to be able to supply customers.

In the Central West it is probably true that stocks have had to be increased slightly more than in the East, although in some parts of the South business has been so poor that some jobbers have not thought it advisable to further increase stocks.

These figures, of course, refer to the entire stock. In separate portions of the stock, of course, different conditions exist, dependent largely on volume of demand, distance from source of supply and ability of manufacturer to supply goods in a reasonable time.

Furthermore, it is well known that in certain portions of the stock supplies are far below what is desired. This situation in incandescent lamps and rubber-covered wire has been particularly acute in certain sections of the country at various times.

Of course, owing to the increased cost of supplies and therefore the additional amount of capital that must be tied up in stock, jobbers generally have been very careful not to increase their stocks any more than has been necessary. There have, naturally, been exceptions, but manufacturers through their credit departments early realized that it was dangerous to allow the trade to stock beyond its ability to carry the investment, even though there was a brisk demand, and consequently limited jobbers as far as was advisable to their financial ability to carry this stock.

While deliveries continue to be as long as they now are and as uncertain, it is evident that jobbers will find little opportunity to reduce the amount of stock, provided always, of course, that the demand does not fall off.

The jobbers practically are forced to carry stock for the contractor and dealer. These two elements of the trade, as a rule, buy only as required. They do not stock up ahead to any great amount, and during this period of poor deliveries have made little or no change in the customary practice, but have gone to the jobber for goods as wanted. In fact, owing to the advanced prices numerous instances exist where the contractor and dealer have recently depended more than ever before on the jobber to carry their stocks.

EXISTING CONDITIONS IN THE METALS MARKET

Copper Is Strengthened by Purchases, Tin Is Down Somewhat, and Business in Spelter Market Is Stagnant

A well-defined buying movement for a few days sent copper prices up a bit, but toward the end of last week they receded to a level slightly higher than for the previous week. The market, however, is still wondering what the federal and allied governments purpose to do regarding future requirements. Producers have had no intimation of how much will be needed nor how much the government will be willing to pay. There is a feeling, however, that the price of 16 2/3 cents at which the government contracted for earlier requirements will not hold, but that the government will probably be willing to pay around 25 cents a pound.

Strikes, fires, etc., have held up production somewhat, but at this writing word has been received from most of the prominent producers that the men are going back to work.

The spelter market is stagnant. Neither buyers nor sellers seem inclined to do business. Quotations on tin have fallen from the higher prices of a few days ago. There seems to be little change in the lead market, the high prices still prevailing.

Nominal quotations on electrolytic copper were as follows on June 4: June, 32.75 cents; July, 31.75 cents; third quarter, 30 cents; fourth quarter, 29 cents.

NEW YORK METAL MARKET PRICES

	May 28 Selling Prices Bid	Asked	June 4 Selling Prices Bid	Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	31.50	to 32.50†	31.00	to 32.00†
Electrolytic	32.25	to 32.75†	32.50	to 33.00†
Casting	30.50	to 31.00†	30.50	to 31.00†
Copper wire base	37.00	to 38.00†	37.00	to 38.00†
Lead	10.00		10.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.42½	to 9.67½	9.55	to 9.67½
Tin, Straits	65.00		61.00†	
Aluminum, 98 to 99 per cent.	56.00	to 58.00†	56.00	to 58.00†

OLD METALS

Heavy copper and wire	28.00	to 28.50	28.00	to 28.50
Brass, heavy	17.50	to 18.00	17.50	to 18.00
Brass, light	14.25	to 14.75	14.25	to 14.75
Lead, heavy	9.00	to 9.25	9.25	to 9.75
Zinc, scrap	7.25	to 7.50	7.25	to 7.50

†Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

Any apparent discrepancies between New York and Chicago quotations can be explained by conditions governing the local markets in each case.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size		List, per 1000 Ft.
No. 14	solid	$61.00
No. 12	solid	71.00
No. 10	solid	90.00
No. 8	solid	106.00
No. 6	solid	145.00
No. 10	stranded	95.00
No. 8	stranded	115.00
No. 6	stranded	160.00
No. 4	stranded	205.00
No. 2	stranded	266.00
No. 1	stranded	315.00

Twin-Conductor

No. 14	solid	104.00
No. 12	solid	135.00
No. 10	solid	185.00
No. 8	stranded	235.00
No. 6	stranded	370.00
No. 4	stranded	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil	$54.90 to $67.16
Coil to 1000 ft.	48.80 to 59.17
No. 12 solid:	
Less than coil	63.90 to 78.10
Coil to 1000 ft.	56.80 to 68.87

Twin-Conductor

No. 14 solid:	
Less than coil	$78.00 to $114.40
Coil to 1000 ft.	75.00 to 100.88
No. 12 solid:	
Less than coil	121.50 to 148.50
Coil to 1000 ft.	108.00 to 120.95

NET PRICE PER 1000 FT.—CHICAGO

Single-Conductor

No. 14 solid:	
Less than coil	$51.85 to $67.10
Coil to 1000 ft.	48.80 to 54.90
No. 12 solid:	
Less than coil	60.35 to 78.10
Coil to 1000 ft.	56.80 to 63.90

Twin-Conductor

No. 14 solid:	
Less than coil	$85.00 to $114.40
Coil to 1000 ft.	77.50 to 93.60
No. 12 solid:	
Less than coil	114.75 to 148.50
Coil to 1000 ft.	108.00 to 121.50

ATTACHMENT PLUGS

	Std. Pkg.	List
Benjamin No. 902	100	$0.25
Hubbell No. 5406	200	.10
Bryant No. 700	100	.25
G. E. 50996	250	.22

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.:	
Benjamin No. 903	12%
Hubbell No. 5406	+10% to 20%
Bryant No. 700	+20% to 10%
G. E. 50996	+20% to 10%
1/5 to std. pkg.:	
Benjamin No. 903	20%
Hubbell No. 5406	10% to 20%
Bryant No. 700	20%
G. E. 50996	20%
Std. pkg.:	
Benjamin No. 903	44%
Hubbell No. 5406	34%
Bryant No. 700	34%
G. E. 50996	34%

ATTACHMENT PLUGS—CONTINUED

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.:	
Benjamin No. 903	12%
Hubbell No. 5406	10% to +10%
Bryant No. 700	+20%
G. E. 50996	+20%
1/5 to std. pkg.:	
Benjamin No. 903	20%
Hubbell No. 5406	10% to 20%
Bryant No. 700	Net
G. E. 50996	Net
Std. pkg.:	
Benjamin No. 903	44%
Hubbell No. 5406	34%
Bryant No. 700	30%
G. E. 50996	30%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 50	.30	.30
50 to barrel	.28	.28 to .29
Barrel lots	.24	.24

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 30	.30	.30
50 to barrel	.255 to .26¼	.265 to .27¼
Barrel lots	.24 to .24¾	.25 to .25¾

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25-50	35.00
2	25-50	45.00
2½	25-50	52.00

DISCOUNT PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	.....	.....
⅜-in. double strip	.....	.....
½-in. single strip	Net to 20%	4% to 25%
½-in. double strip	Net to 10%	4% to 20%

DISCOUNT PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$71.25 to $75.00	$60.00 to $63.75
⅜-in. double strip	75.00 to 78.75	67.50 to 71.25
½-in. single strip	95.00 to 100.00	80.00 to 85.00
½-in. double strip	100.00 to 105.00	90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot	Size, in	List, per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

CONDUIT, NON-METALLIC FLEXIBLE—CONTINUED

DISCOUNT PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	Net to 33⅓%	45% to 50%	53% to 55%
¼-in.	Net to 33⅓%	45% to 50%	53% to 55%

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$36.67 to $55.00	$27.50	$24.75
¼-in..	40.00 to 60.00	30.00	27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Size, in.	Conduit, List per Foot	Couplings, List	Elbows, List
¼	$0.08½	$0.05	$0.19
⅜	.08½	.06	.19
½	.08½	.07	.19
¾	.11½	.10	.25
1	.17	.13	.37
1¼	.23	.17	.45
1½	27½	.21	.60
2	.37	.28	1.10
2½	.58½	.40	1.80
3	.76½	.60	4.80

DISCOUNT—NEW YORK

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	6%	8%
2500 to 5000 lb.	9%	11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	3.8% to 7.8%	5.8% to 9.8%
1500 to 5000 lb.	6.8% to 10.8%	8.8% to 12.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net	$3.15 to $3.50

CHICAGO

Net	$2.80 to $3.85

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

FUSES, INCLOSED—CONTINUED

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.....	$5.75 to $6.30
1/5 to std. pkg.....	4.50 to 5.25

Standard package, 500. List, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.....	$6.25
1/5 to std. pkg.....	5.25

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B.....	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25.....	50	.50
25-watt—G 25.....	50	.50
40-watt—G 25.....	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30.....	24	.72
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35.....	24	1.05

105 to 125 Volts

DISCOUNT—NEW YORK

Less than std. pkg.....Net
Std. pkg. 10%

DISCOUNT—CHICAGO

Less than std. pkg.....Net list
Std. pkg. 10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)....	$30.00 to $35.17
Coil to 1000 ft.	21.00 to 26.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)..	$37.52 to $38.16
Coil to 1000 ft.	28.14 to 28.62

LAMP GUARDS, WIRE

NEW YORK

	Per 100 Net
Less than 50, Matthews, 16-cup	$18.00 to $20.00
Less than 1/5 std. pkg. Hubbell	25.50 to 29.00
Less than 36, 60-watt Loxon	20.00 to 25.00

CHICAGO

	Per 100 Net
Less than 50, Matthews, 16-cp.	$20.00
Less than 1/5 std. pkg. Hubbell	$22.50 to 28.35
Less than 36, 60-watt Loxon	25.00 to 30.00

OUTLET BOXES

Union Cat. No.	Black, List, per 100
101	$30.00
102	30.00
103	25.00
106	20.00

Union Cat. No.	Galv., List, per 100
101	$30.00
102	30.00
103	25.00
106	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	List to 33%	List to 27%
$10.00 to $50.00 list.....	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list.....	40%	35%
$10.00 to $50.00 list.....	50%	45%

PIPE FITTINGS

Condulets, V.V., Unilets and Similar

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....10%
1/5 to std. pkg.....20%
Std. pkg. 30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....10%
1/5 to std. pkg.....20%
Std. pkg. 30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg....$14.00 to $20.00	
1/5 to std, pkg.	13.00 to 15.10

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.....$14.00 to $18.00	
1/5 to std. pkg.....	13.00

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

	5½ N.C.—Solid Std. Pkg.	Nail-lt—N.C. Std. Pkg.
Per 1000 Net	3500	4000
Less than 1/5 std. pkg.....$10.50 to $24.50		$21.50
1/5 to std. pkg.....	9.75 to 12.15	28.50

CHICAGO

	5½ N.C.—Solid Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Per 1000 Net		
Less than 1/5 std. pkg. ....$10.50 to $18.00		$20.75 to $28.00
1/5 to std. pkg.	9.00 to 9.75	16.30 to 21.50

SOCKETS AND RECEPTACLES

	Std. Pk.	List
⅛-in. cap key socket.....	500	$0.33
⅛-in. cap keyless socket..	500	.30
⅛-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....Net
1/5 to std. pkg. .....15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....Net to 15%
1/5 to std. pkg.....15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

Perkins or Trumbull Type A:	List
30-amp. S. P. S. T.....	$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30 amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.80
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Perkins Type B or Trumbull Type C:	
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

Type A, Perkins or Trumbull:
Less than $10 list .....+50%
$10 to $25 list.....11% to 15%
$25 to $50 list..... 14% to 18%
Type B, Perkins, or Type C, Trumbull:
Less than $10 list 5%
$10 to $25 list.....16% to 20%
$25 to $50 list.....24% to 28%

SWITCHES, KNIFE—CONTINUED

DISCOUNT—CHICAGO

Type A, Perkins or Trumbull:
Less than $10 list.....Net to +5%
$10 to $25 list.....11% to 15%
$25 to $50 list.....14% to 18%
Type B, Perkins, or Type C, Trumbull:
Less than $10 list ..... 5% to 10%
$10 to $25 list.....16% to 20%
$25 to $50 list.....24% to 28%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole.....	250	$0.28
5-amp. single-pole, ind....	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind....	100	.54
5-amp., three-point	100	.56
10-amp., three-point	50	.76
10-amp., 250-volt, D. P....	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....Net
1/5 to std. pkg.....15%
Std. pkg. 28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. .....Net to +20%
1/5 to std. pkg. .....15% to Net
Std. pkg. 30%

SWITCH BOXES, SECTIONAL CONDUIT

C. F. Mfg. Co.	List, Each
No. 155	$0.34
No. 160	0.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list....	....	....
$2.00 to $10.00 list.....	....	....
$10.00 to $50.00 list....	....	....

DISCOUNT—CHICAGO

	Black.	Galvanized.
Less than $10.00 list	35% to 50%	15% to 40%
$10.00 to $50.00 list	35% to 64%	25% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price .....$3.15 to $3.50

CHICAGO

Net price .....$2.80 to $3.50

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools..	$0.52 to $0.62
No. 18, full spools.....	0.48 to 0.53

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0.56½ to $0.65
No. 18, full spools	0.49½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

No.	Price per 1000 Ft. Net—Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14 ...	$18.00	12.00-14.50	11.50-12.50
12 ...	21.06-27.05	18.96-22.85	18.01-20.95
10 ...	29.60-39.27	26.64-33.66	24.68-25.31
8 ...	42.40-51.44	38.16-48.42	33.51-36.25
6 ...	72.19-89.57	64.98-76.80	56.63-61.73

CHICAGO

No.	Price per 1000 Ft. Net—Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14 ...	$18.00	$16.00	$14.00
12 ...	25.92-29.89	22.05-25.62	19.44-21.35
10 ...	36.48-41.51	31.92-35.58	27.36-29.65
8 ...	46.20-60.13	42.35-51.54	37.70-42.95
6 ...	72.70-82.20	66.65-75.35	59.40-68.50

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$40.25 to $45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.....	$42.55 to $45.00
25 to 50 lb.	41.35 to 44.00
50 to 100 lb.	40.35 to 43.00

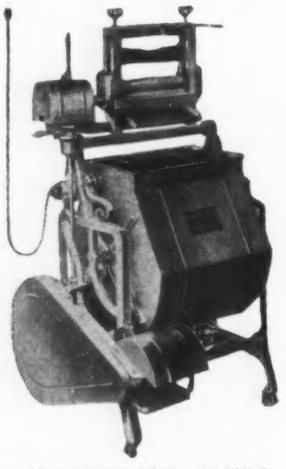
NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Washing Machine

Electric washers have been developed by the Apex Appliance Company, 3223 West Thirtieth Street, Chicago, which operate on the oscillating-tub principle. All-metal tubs with approximate triangular cross-section and the peak or "apex" at the bottom are used. V-shaped strips are attached horizontally to the sides as well as on the bottom to serve as shoulders and give a positive throw to the contents when the tub is oscillated. At the bottom of the tub is a settling chamber and drainage pipe. All the heavier dirt drops into this and cannot be carried back into the clothes. By drawing off the dirtiest water after each batch of clothes is washed it is unnecessary to renew all the water for each tubful. The tub rests upon two outside bearings so there is no chance of lubricating oil mixing with the clothes. The bearing spindles are attached to the tub through spiders which strengthen the tub and distribute the stresses due to its oscillation, thereby preventing twisting of the bearing at the end where the power is applied.

The lever shown at the left in the accompanying illustration serves to start and stop the motion of the tub. When this lever is put in the running position it engages a clutch. This starts a shaft to which are connected an arm and spring by which the tub is oscillated. The spring serves to retard the motion



OSCILLATING TUB WASHER

at the end of the oscillation and start the tub back in the opposite direction; thus very little power is required to overcome the inertia of the load at each end of the oscillation.

The main shaft and the wringer shaft, which is gear-connected to it, are in motion continually when the motor is running. The small hand lever at the top is employed to control the wringer. A safety catch is provided which makes it impossible to start the tub until the catch is released. The wringer can be operated in several positions. The outfits are belt-driven by Robbins & Myers special washing-machine motors rated at ⅛, ⅙ or ¼ hp., depending upon the size of the washer.

Kitchenette Range

An electric kitchenette range which is a variation from the ordinary combination of hot plates and oven has been developed by the Standard Electric Stove Company of Toledo, Ohio, to meet the requirements of small kitchens. The oven is pivoted at the outside corner so it will swing over the hot plates and thus not require separate heating elements. There is an open-coil air heater

RANGE ON WHICH OVEN IS PIVOTED

in the top of the oven for broiling, toasting, etc. The oven has double walls, which are insulated and lined with aluminum. With both burners operating at full intensity the oven will attain its maximum temperature in four minutes, it is said. Each hot plate is controlled by a three-heat multiple switch which regulates the power demand to 1000, 500 or 250 watts as desired. To prevent radiation of heat from the bottom of the hot plates they are insulated by bowl-shaped inclosures.

Electric Washers

Two new models have been added to the line of washing machines of the One Minute Manufacturing Company of Newton, Iowa. A feature of one of these machines is the floating motor, which acts as a belt tightener. The motor is hinged to the motor base and thus takes up all slack in the belt. These models are equipped with a high-grade wooden-frame wringer of the swinging style, which is reversible and is provided with a quick-acting safety-release device. All gears are fully inclosed. Two levers control the machine.

Load Box

By various switching combinations any resistance loads from 25 watts to 2000 watts can be obtained with the load box shown in the accompanying illustration, which is made for non-inductive testing of meters. This load box is neat in appearance and weighs

METER-TESTING LOAD BOX

only 5 lb. (2.7 kg.). All metal parts are nickeled and the switch handles and top cover consist of polished ebonite. This box is the product of the William H. Dalton Company, 4 Charlotte Street, Salem, Mass.

Vertical-Type Alternator

An improved vertical-type alternator has been developed by the Electric Machinery Company of Minneapolis, Minn. The lower guide bearing, which resists all lateral stresses on the shaft, is split and is so mounted that it can be removed without disturbing the shaft or coupling. It is provided with an automatic forced-feed oiling system, which is equipped with a sight feed indicator placed where it can be easily observed. The armature frame or stator is a circular iron casting of the lightest practical construction and is designed to allow free circulation of cooling-air currents.

Open-type armature slots are used on these alternators. At both ends of the laminated core are special tooth supports that prevent humming and chafing of the coils. The supports are made of "U" shaped punched-steel strips riveted to each other at the open ends so as to form a continuous chain of loops, each one of which supports one tooth. Being open at the lower end the loop allows free exit of air set in motion by the revolving field. The tooth support is locked in position by two tongues fitting in the annular groove in the clamping ring against which it rests. Ventilation of the

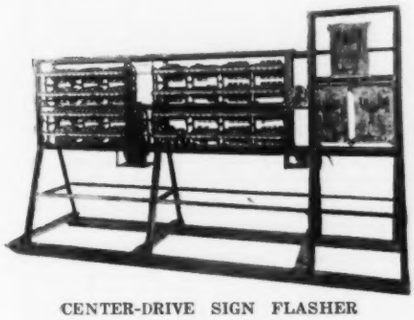
armature core is secured by means of open spaces at intervals along the core and by the open tooth supports at both ends. In case an armature coil is damaged it may be removed by lifting the adjacent coils and replaced immediately by a spare coil if one is on hand. The top-bearing bracket is cast in one piece and is doweled to the thrust-bearing case. The openings between the radial arms are covered with wire-screen frames.

The total weight of the rotor and waterwheel runner, including the water thrust, is suspended from a large hexagonal nut screwed to the upper end of the shaft. This nut rests on a thrust plate which in turn rests on a roller bearing provided with self-aligning washers. These washers insure an evenly distributed load on all the rollers by adjusting themselves to any slight inaccuracies in the support. The rollers are not all of equal lengths. Therefore they may be staggered so that it will be impossible for them to wear grooves or tracks in the steel plates between which they roll. The bearing is completely submerged in oil.

Oil passages are provided in the lower self-aligning washer in order to permit the circulation of oil through the rollers. On the larger machines the upper thrust-bearing case is connected with the oil pump at the lower part of the alternator, thereby permitting continuous flow of cool oil around the bearing. The side thrust of the shaft is resisted by a self-aligning radial ball-bearing.

Sign Flasher

The Reynolds Electric Company, 422 South Talman Avenue, Chicago, has designed a flasher for large electric signs which, it is pointed out, is compact and simple in design. One display operated by this flasher consists of a three overlay sign, flashing first the reading matter, "You Will Do Better in Toledo," with a highly colored revolving border; next a steamship with smoke pouring from the funnels, waving flags, and an ocean-wave effect; lastly, an express train coming on full



CENTER-DRIVE SIGN FLASHER

head, then slowing to a stop and gradually starting up again.

The flasher has 132 switches in addition to the solenoid controls. Center drive is used, which, it is claimed, gives perfect transmission without excessive bearing and gear less. The motor at the end drives a twelve-switch section of the flasher which operates the engine wheels, car wheels and track. The rheostat causes the motor to come up to full speed in graduated steps, giving the accelerating effect in the wheels and track. The solenoids act as master of the control switches.

Weatherproof Sockets

Two molded composition weatherproof sockets, known as Nos. 60,666 and 43,310, have been placed on the market by the Arrow Electric Company of Hartford, Conn. These sockets are grooved for weatherproof shade holders and are equipped with 6 in. (15.24 cm.) of No. 14 B. & S. gage stranded rubber-covered wire.

Portable Oven

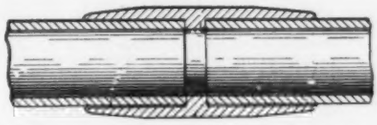
The Almur Manufacturing Company of Marion, Ind., has developed a portable oven equipped with a removable heating unit. The heating element is held in place with wing nuts, which makes it convenient to remove the element to clean the stove thoroughly. The heating element is wound for 600 watts

PORTABLE STOVE WITH REMOVABLE HEATING UNIT

and 110 volts. This stove is 12 in. (30.48 cm.) long by 12 in. (30.48 cm.) wide by 16 in. (40.6 cm.) high. A glass door with a nickel-plated cast-iron frame is provided.

Conduit Coupling

A tubular slip coupling for conduit pipes has been developed by M. Blumenthal, 50 Church Street, New York City. The coupling consists of a sleeve



SLIP COUPLING FOR CABLE CONDUITS.

the outer surface of which is tapered toward each end to form cutting edges. These edges facilitate driving the conduit through a wall or partition. The inner surface is beveled at the ends to permit inserting the conduits readily.

Push-Button Switch

Push-button switches designed to be mounted directly on the busbars of standard panels by means of two machine screws which pass through the flexible self-adjusting contacts of the switch into holes tapped in the copper busbars of the panel are made by the

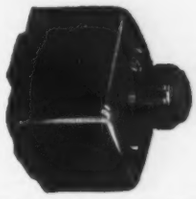
SWITCH FOR BUSBAR MOUNTING

Bryant Electric Company of Bridgeport, Conn. The same screws also serve as the circuit or electrical connection between the switch and the busbars.

The National Electrical Code permits a minimum spacing between busbars of opposite polarity of ¾ in. (1.9 cm.) for 125 volts and 1¼ in. (3.1 cm.) for 250 volts, but as the spacings at the fuses must be 1 in. (2.54 cm.) for 125 volts and 1¾ in. (4.4 cm.) for 250 volts, it is the practice to space the busbars 1½ in. (3.8 cm.) on centers for 125 volts and 2¼ in. (5.7 cm.) on centers for 250 volts.

As the screw holes in these switches are spaced 1¼ in. (3.1 cm.) on centers both ways, it is claimed that the switches can be used on 125-volt panels with straight busbars, and that the space between the ends of the bus of the same polarity may be ¾ in. (1.9 cm.) greater than is necessary with other types of switches—thus effecting an actual saving of 1½ in. (3.8 cm.) of copper bar per switch. On 250-volt panels it is necessary to bend the ends of buses in to reach the switch. The covers of these switches are substantial molded insulation cups, rectangular in shape, with all front edges rounded.

Below the buttons of each switch there is a metal card holder designed to hold a lettered card designating the circuit controlled. These switches are made in both 10-amp. and 20-amp., 250-volt standard push-button types and they can also be procured in the lock type.



ROTARY INDICATING SWITCH

A rotary indicating panelboard switch can also be had, rated at 10 amp. and 250 volts. This switch is attached to busbars in the same manner as the push-button type, and if desired can be readily converted into a lock switch by substituting for the standard form of handle generally employed a universal lock attachment.

Trade Publications

CHAIN DRIVE.—"Ideal Drive for Grain Elevators" is the title of a bulletin prepared by the Link-Belt Company of Chicago.

RANGES.—The Hughes Electric Heating Company of Chicago is distributing a leaflet entitled "Just a Word About Prices on Hughes Ranges."

APPLIANCES.—The Pelouze Manufacturing Company, 232 East Ohio Street, Chicago, has prepared a bulletin descriptive of its electrical devices.

APPLIANCES.—Landers, Frary & Clark of New Britain, Conn., have prepared an illustrated folder descriptive of "Universal" electric summer needs.

SPOT WELDER.—The Pacific Electric Welder & Manufacturing Company of Seattle, Wash., is distributing a folder descriptive of its spot welder.

SWITCHES.—Steel-inclosed switches are illustrated and described in a leaflet distributed by the Detroit Fuse & Manufacturing Company of Detroit.

REFLECTORS.—X-ray standard window reflectors are illustrated and described in the bulletin prepared by the National X-ray Reflector Company of Chicago.

REFLECTORS.—"The Influence of Lighting on Church Attendance" is the title of a bulletin recently prepared by the National X-Ray Reflector Company of Chicago.

PRESIDENT'S ADDRESS.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is distributing in book form the address by President Wilson before the Sixty-fifth Congress on April 2, 1917.

ELECTRIC RANGES AND HEATING DEVICES.—The Globe Stove & Range Company, Kokomo, Ind., has issued catalog No. 39, which contains complete information on electric ranges and heating devices. In addition to containing the usual catalog information this booklet gives short, concise sales talks about each piece of apparatus.

REFLECTORS.—"Holophane Developments for Type C Lamps" is the title of a bulletin prepared by the Holophane Glass Company, 340 Madison Avenue, New York City. This book is published for the purpose of acquainting the dealer with the developments which have been made in the Holophane system of illumination, particularly with reference to units for type C lamps.

PUMPS.—The De Laval Steam Turbine Company of Trenton, N. J., has just issued, under the title "Progress in Water Works Pumps," a forty-eight-page booklet discussing the general economic and engineering conditions affecting the design and installation of such pumps. Installations in fifteen of the principal cities of this country and Canada are described, including thirty-four units aggregating 999,000,000 gal. per day capacity. The publication should be of value to any one interested in the handling of water in large quantities.

CONTROL EQUIPMENT.—"Booklet E" is the title of the new thirty-two-page booklet just published by the Cutler-Hammer Manufacturing Company, Milwaukee, describing C-H control equipment for electric elevators. This booklet covers the various classes of control, such as hand-rope control, car-switch control and push-button control, for all classes of freight and passenger service. The booklet is well illustrated and also contains information on elevator control accessories, such as door safety switches, phase failure and phase reversal relays, limit switches, slack cable switches, brakes, etc.

ILLUMINATION.—Arrangements have been made for the publication of a lecture course on illuminating engineering which was given at the University of Pennsylvania under the auspices of the Illuminating Engineering Society and the university Sept. 21 to 28, 1916. The lectures treat of the principles and practice of illuminating engineering, with special reference to the practical aspects of the art. These lectures constitute the most comprehensive treatment of the subject that has ever been offered to the practitioner, it is said. The lectures are printed in one volume of approximately 700 pages, illustrated and bound in cloth. It contains twenty-one lectures, all indexed, and a supplement illustrating and describing the exhibition which was prepared in connection with the lecture course. The cost of this volume until July 1, 1917, will be $4.

BUREAU OF MINES.—The Bureau of Mines of the Department of the Interior announces new publications on the following topics: Coal-mine fatalities in the United States, 1916, by A. H. Fay; bulletin 119, analyses of coals purchased by the government during the fiscal years 1908-1915, by G. S. Pope; bulletin 143, abstracts of current decisions on mines and mining, reported from May to August, 1916, by J. W. Thompson; technical paper 87, methods of testing natural gas for gasoline content, by G. A. Burrell and G. W. Jones; technical paper 106, asphyxiation from blast-furnace gas, by F. H. Willcox; technical paper 165, quarry accidents in the United States during the calendar year 1915, by A. H. Fay; technical paper 168, metal-mine accidents in the United States during the calendar year 1915, by A. H. Fay. Only a limited supply of these publications is available for free distribution, and applicants are asked to co-operate in insuring an equitable distribution by selecting publications that are of especial interest. Requests for all papers cannot be granted. Publications should be ordered by number and title. Applications should be addressed to the director of the Bureau of Mines, Washington, D. C.

New Incorporations

THE SEWICKLEY HEIGHTS (PA.) TOWNSHIP LIGHT COMPANY has been incorporated with a capital stock of $5,000 by E. S. Haymond of Wilkinsburg, Pa., and others to operate in Sewickley Heights.

THE CONWAY (PA.) ELECTRIC LIGHT COMPANY has been granted a charter with a capital stock of $5,000 to operate in Conway. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE AMBRIDGE (PA.) ELECTRIC COMPANY has been granted a charter with a capital stock of $5,000 to operate in Ambridge Township. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE OSTERBURG (PA.) LIGHT, HEAT & POWER COMPANY has been chartered to install and operate an electric lighting system in Osterburg and vicinity. D. E. Brumbaugh of Claysburg is interested in the company.

THE STERLING ELECTRICAL CORPORATION of Cleveland, Ohio, has been incorporated with a capital stock of $250,000 by Roy M. Hall, W. H. Fahrenbach, Clarence E. Edson, P. Hess and Antonio Longoria.

THE BADEN (PA.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of $5,000 to furnish electrical service in Baden. E. S. Haymond of Wilkinsburg, Pa., is among the incorporators.

THE ALIQUIPPA (PA.) ELECTRIC LIGHT COMPANY has been chartered with a capital stock of $5,000 to supply electricity in Aliquippa Township. E. S. Haymond of Wilkinsburg is among the incorporators.

THE CRESCENT (PA.) TOWNSHIP ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 to operate in Crescent Township. E. S. Haymond of Wilkinsburg, Pa., is among the incorporators.

THE ECONOMY (PA.) TOWNSHIP ELECTRIC LIGHT COMPANY has been chartered with a capital stock of $5,000 to operate in Economy Township. E. S. Haymond of Wilkinsburg, Pa., is among the incorporators.

THE CENTRAL ELECTRICITY COMPANY of Herbertville Station, Que., has been incorporated by J. H. Bassard, J. R. Desbiens, A. Plourde and others. The company is capitalized at $99,000 and proposes to build and operate electric light, heating and power plants.

THE ANTWERP (OHIO) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $20,000 by William J. Peterson, G. M. Bratton, F. L. Armstrong, Charles H. Worden and others. The company proposes to furnish electrical service in Antwerp.

THE PALMETTO POWER & LIGHT COMPANY of Raleigh, N. C., has been incorporated with a capital stock of $300,000 by Charles E. Johnson, H. H. Carr and F. H. Briggs, all of Raleigh. This company is a subsidiary to the Carolina Power & Light Company of Raleigh.

THE BILLINGS (MONT.) RAILWAY, LIGHT & POWER COMPANY has been incorporated by T. A. Snidow, H. W. Rowley, J. B. Arnold, Roy J. Covert and others. The company is capitalized at $300,000 and proposes to take over the local street car system and possibly construct an interurban railway to Laurel and other places.

Trade Notes

THE HUGHES ELECTRIC HEATING COMPANY, Chicago, Ill., has moved to 5660 West Taylor Street.

A. M. COLLINS has been appointed sales manager of the Detroit office of the Western Electric Company.

THE INDEPENDENCE INSPECTION BUREAU, Philadelphia, announces that it is now called the Independence Bureau.

THE DRAEGER OXYGEN APPARATUS COMPANY has moved from Pittsburgh to Penn Avenue and Hay Street, Wilkinsburg, Pa.

THE BLAW STEEL CONSTRUCTION COMPANY, Pittsburgh, Pa., has announced the appointment of G. E. Land as advertising manager.

THE H. W. JOHNS-MANVILLE COMPANY opened on May 20 new and larger showrooms and sales offices on the ground floor of the Westinghouse Building, corner of Ninth Street and Pennsylvania Avenue-Pittsburgh, Pa.

E. C. WOODBURY, for a number of years with the Standard Underground Cable Company as assistant to the manager, has resigned from that company to manage the Southwestern business of the Belden Manufacturing Company of Chicago.

THE WAGNER ELECTRIC MANUFACTURING COMPANY of St. Louis announces the appointment of F. T. Coup, formerly connected with its Chicago office, to take charge of its Milwaukee office in its new location, the First National Bank Building.

THE UNDERWRITERS' LABORATORIES announce as additions to their casualty council the following: Col. Lewis T. Bryant, Commissioner of Labor of the State of New Jersey, Trenton, N. J.; Lew R. Palmer, Department of Labor and Industry, Harrisburg, Pa., and A. H. Young, director of the American Museum of Safety, New York.

C. L. HIGHT and FRANK STOUT have formed a partnership under the name Hight & Stout, 143 Liberty Street, New York City, to operate as factory selling agents, covering the Middle Atlantic States from New York to Virginia. The first account of the new firm will be that of district representative for Henry D. Sears, general sales agent for Webber sockets.

THE MONITOR CONTROLLER COMPANY of Baltimore, manufacturer of automatic starters and controllers for all kinds of motor-driven machinery, announces the opening of a new office in Buffalo, at 718 Ellicott Square, under direction of William G. Merowit. This office will have charge of business in the western New York territory, also Canadian territory adjacent to Toronto and Hamilton.

THE CHARLES A. SCHIEREN COMPANY, New York, manufacturer of "Duxbak" water-proof and steam-proof leather belting, has recently opened branch offices at 72 Congress Street, West, Detroit; 18 South Broadway, St. Louis; 475 South Main St., Memphis, and 272 Marietta Street, Atlanta, in addition to those already established at New Orleans, Dallas, Boston, Philadelphia, Pittsburgh, Chicago, Denver and Seattle.

THE BETTS & BETTS CORPORATION, 511 West Forty-second Street, New York City, has taken over the manufacturing and selling rights of the "Mason Monogram" talking sign and carriage call, which has been exploited in the past by the National Electric Sign Company of Jersey City, N. J. The latter company recently retired from business. James H. Betts, sales manager for the Betts & Betts Corporation, announces that several important improvements have been made in the operating mechanism of the carriage call, incorporating many of the Betts company's own patented features.

RUSSIAN COMMISSION.—A commission representing the National Bank of Commerce in New York has left New York for Russia. This mission is a constructive step toward cementing definite commercial relations between Russia and the United States, and it goes at the specific suggestion of several correspondents of the bank in Russia. The commission will be headed by R. G. Hutchins, Jr., senior vice-president of the bank, who will be accompanied by H. P. Barrand, an assistant cashier from the bank's foreign department, and several assistants. The party will spend some time in Japan and go from there to Russia, where they will remain from two to three months. Prior to their return trip they will spend considerable time in Scandinavian countries.

New England States

DAMARISCOTTA MILLS, ME.—Burges, Lang & Company of Boston, Mass., who are promoting the construction of an electric railway from South Newcastle to Boothbay Harbor, have acquired a controlling interest in the Portland Power & Development Company of Damariscotta Mills. The company, it is understood, is considering acquiring the Wiscasset, Waterville & Farmington Railroad, which is operated by steam.

BURLINGTON, VT.—Steps have been taken by the Burlington Merchants' Association to secure a new street-lighting system in the business district.

LUDLOW, VT.—Contracts aggregating 200 hp. to furnish electricity to some of the local woolen mills from the municipal electric-light plant have been secured by the village of Ludlow. As energy is purchased from the Colonial Power & Light Company of Cavendish, it will be necessary to double the capacity of the substation to supply the service.

WEST DANVILLE, VT.—A new electric power plant to develop 2500 hp., it is reported, is to be erected in West Danville by the Hortonia Power Company of Brandon, Vt. The plans provide for the erection of 30 miles of electric transmission lines, including the line from West Danville to Barnet and the Pike Hill copper mines and connecting the new plant with those of the company at Barnet, Groton and Ryegate. The contract for construction work has been awarded to Pascal Ricci of Rutland.

BOSTON, MASS.—Governor McCall has signed the bill authorizing the Bay State Street Railway Company to sell electrical energy to the Fore River Shipbuilding Corporation during contracts for naval construction.

FALL RIVER, MASS.—The Fall River Electric Light Company is contemplating the construction of a trunk line of conduits through the southeastern end of the city this summer.

WOONSOCKET, R. I.—The Manufacturers' Power Company has purchased a site at Second Avenue and River Street and is planning the construction of a coal pocket for the power plant on Singleton Street.

HARTFORD, CONN.—The directors of the Hartford Electric Light Company have voted to recommend to the stockholders an increase of capital stock from $4,500,000 to $6,000,000.

MOODUS, CONN.—The Public Utilities Commission has approved the petition of the Central Connecticut Power & Light Company of East Hampton for the construction of an electric transmission line, using double galvanized wire, from Moodus to East Glastonbury.

Middle Atlantic States

COHOES, N. Y.—Bids will be received by the Board of Contract and Supply, Cohoes, until June 13 for two motor-generator sets, including switchboards, conduits, cables, etc., for the pumping station and filtration plant.

EARLVILLE, N. Y.—The Public Service Commission has granted the Earlville Electric Light Company permission to erect an electric transmission line to Randallsville; also to erect a line to the town of Lebanon and to exercise franchises granted by the town of Lebanon and to issue $7,000 in bonds of which the proceeds of $5,535 will be used to pay for the new line.

HUDSON, N. Y.—The power plant, blacksmith shop, etc., at the plant of the Atlas Building Material Company, just north of Hudson, was recently destroyed by fire, causing a loss of about $10,000.

PORT CHESTER, N. Y.—Bids will be received by the Board of Trustees of the village of Port Chester until June 12 for sewage-pumping machinery, including one 1000-gal. per minute and two 2000-gal. per minute special centrifugal sewage pumps, one 15-hp. and two 25-hp. horizontal electric motors with switchboards, control apparatus and other appurtenances. Specifications and further information may be obtained at the office of Louis C. A. Lewin, village clerk, or at the office of James C. Harding, consulting engineer, 170 Broadway, New York City.

SIDNEY CENTER, N. Y.—The Town Board of Sidney has granted the Delaware & Otsego Electric Light Company of Franklin permission to install electric lamps in Sidney Center.

WYNANTSKILL, N. Y.—The installation of an electric-light system in this village and along the Wynantskill Flats is under consideration. Electricity to operate the system would be obtained from the Wynantskill Hydraulic Electric Power Company.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

ATLANTIC CITY, N. J.—Arrangements are being made for the installation of powerful searchlights along the beach front in Atlantic City in the near future by W. Frank Sooy, director of public safety. Four sections of the bathing beach will be lighted under the present plan.

ELIZABETH, N. J.—Owing to the increase in cost of material, etc., Runyon & Carey, consulting engineers of Newark, have advised against the construction of a municipal electric plant at the present time.

ENGLEWOOD, N. J.—Bids will be received by the Board of Education of Englewood until June 14 for electrical work and heating and ventilating in the new Lincoln School, to be located on Englewood Avenue, near William Street. Guilbert & Batelle, 665 Broad Street, Newark, are architects.

KEYPORT, N. J.—The Public Utilities Commission has given its approval of the merger of the Monmouth Lighting Company and the Middlesex & Monmouth Electric Light, Heat & Power Company. The commission has also approved the application of the Monmouth Lighting Company to issue $267,000 in capital stock and $440,000 in bonds.

KEYPORT, N. J.—Permission has been granted by the Board of Public Utility Commissioners to the Jersey Central Traction Company and the Central New Jersey Traction Company to consolidate under the latter name. The Jersey Central Traction Company has been given authority to sell its power station, transmission lines and substations to the Monmouth Lighting Company, and stocks, bonds, etc., to the Middlesex & Monmouth Electric Light, Heat & Power Company.

NEWARK, N. J.—Plans are being prepared by the Public Service Electric Company for the construction of an addition to its Essex power plant at Point-No-Point, to cost about $365,000. N. A. Carle is chief engineer.

NEWARK, N. J.—The Public Service Electric Company has been granted permission by the Board of Freeholders to make tests at electric generating plants at the Overbrook and Soho hospitals. The company claims that it can furnish electricity at a lower cost to these institutions than the present isolated plants.

NEWARK, N. J.—The Public Service Electric Company has submitted a proposal to the building committee offering to supply electricity for the City Hall at less than it can be supplied by the City Hall plant. If it is decided to purchase energy from the company some changes to the system, involving an expenditure of $10,000, would be necessary. A committee has been appointed to make investigations.

TRENTON, N. J.—The Empire Tire & Rubber Corporation is planning to build an addition to its power plant on North Clinton Avenue, to cost about $10,000.

TRENTON, N. J.—Bids will be received by Francis H. Bent, state architect, Department of Architecture, State House, Trenton, until June 22, for electrical work in a new building at the Manual Training and Industrial School at Bordentown.

TRENTON, N. J.—Investigations are under way by the State House committee to reduce the cost of fuel at the various state institutions. It is proposed to install new grates, stokers and other equipment as follows: Rahway Reformatory, $60,000; State Hospital, Trenton, $31,000; Morris Plains, $45,000, and Home for Feeble-Minded, Vineland, $7,000.

WEEHAWKEN, N. J.—Bids will be received by the Board of Education, West New York, N. J., until June 13 for electrical work and heating and ventilating in the new addition to be erected at School No. 5. William Mayer, Jr., and Edwin F. Manahan, 711 Bline Avenue, West New York, are architects.

HECHSHERVILLE, PA.—The Philadelphia & Reading Coal & Iron Company has begun work on the extension of its electric transmission lines to Hechsherville to supply energy in this district.

NEWTOWN, PA.—The plant of the Newtown China Company has been acquired by the Imperial Porcelain Company of Trenton and will be used for the manufacture of electric porcelain specialties. A company has been organized, to be known as the Newtown Porcelain Works, to operate the plant as an auxiliary to the Trenton plant.

PHILADELPHIA, PA.—The Lehigh Coal & Navigation Company is equipping its Cranberry mining properties for electrical operation, at a cost of about $250,000.

PHILADELPHIA, PA.—The contract for the erection of a power plant at the city hospital buildings at Byberry has been awarded to the William Linker Company, Reed Building, at $76,900.

PHILADELPHIA, PA.—Plans have been filed by the Philadelphia Electric Company for the construction of a new one-story power station, 50 ft. by 100 ft., at Robbins Street and Delaware Avenue, to cost about $120,000. A new substation will also be erected as an addition to the present plant at Schuylkill Avenue and Christian Street.

PHILADELPHIA, PA.—An electrically operated double-leaf, central-bascule bridge span is to be included in the new combination bridge and viaduct to be constructed by the city over the Schuylkill River at Thirty-fourth Street, connecting South and West Philadelphia. The span will be about 400 ft. long. The cost is estimated at $1,000,000. Plans are being prepared by Chief Albright of the bureau of surveys.

PITTSBURGH, PA.—Bids will be received by the Board of Education, 1326 Fulton Building, until June 14 for electrical work at the Latimer School. George W. Gerwig is secretary.

PITTSBURGH, PA.—Contract has been awarded by the Pittsburgh, Harmony & Newcastle Railway Company to the Faber Engineering & Construction Company for the construction of a new storage dam and addition to power plant at Harmony Junction.

SHAMOKIN, PA.—The local electric plant of the Pennsylvania Lighting Company, it is reported, was destroyed by fire on June 1.

BALTIMORE, MD.—Plans have been approved for the plant which the American Refractories Company of Joliet, Ill., contemplate erecting at Baltimore, Md. The cost of the proposed plant is estimated at $300,000, and it will be equipped for electrical operation.

PLEASANT VALLEY, W. VA.—The West Virginia Traction & Electric Company of Morgantown has applied to the Town Council of Pleasant Valley to construct and operate an electric-lighting system for a period of 50 years. The company has also applied for a 50-year franchise to construct and operate a waterworks system in the town of Edgwood.

NEWPORT NEWS, VA.—Application has been made to the Chamber of Commerce by the Empire Steel Company, now being organized with a capital stock of $4,000,000, for a selection of a site for the erection of large steel works. It is proposed to build a power plant, to cost about $60,000, in connection with the project. Ernest B. Moore of Petersburg, Va., is interested.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 20 for furnishing and installing lighting fixtures in the United States post offices at Ashland, Ohio; Bonne Terre, Mo.; Buckhannon, W. Va.; Charlotte, Mich.; Dowagiac, Mich.; Middletown, Conn.; Nacogdoches, Tex.; Skowhegan, Me.; Warrenton, Va.; Washington, Ind., and Yoakum, Tex.; also the United States post office extension at Evansville, Ind. For details see proposal columns.

WASHINGTON, D. C.—Extensive improvements are contemplated by the Chesapeake & Potomac Telephone Company, involving an expenditure of about $750,000, and will include an exchange to be installed in the main telephone exchange building, at $225,000; improvements to main building to accommodate the new equipment, $80,000; power plant at main exchange, $30,000; additional toll boards, $35,000; additions to switchboards at Lincoln, Columbia and Cleveland exchanges, $75,000; alterations in the Cleveland Building, for cables and other outside plants, $150,000, and for private branch exchange switchboards, stations and equipment, $100,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, for supplying equipment at various navy yards and naval stations as follows: F.o.b. works, Schedule 1193—34 electrical equipments for rammer and powder hoists, 16-in. elevating gear. Philadelphia, Schedule 1185—two single-acting circulating air pumps. Schedule 1188—two motor-driven 2¼-in. by 24-in. flat-turret lathes. Brooklyn, N. Y., Schedule 1191—miscellaneous copper wire; Schedule 1199—one motor-

driven, high-speed, sensitive 16-in. drill, one universal milling machine, one back-geared, motor-driven, extension screw-cutting lathe. Washington, D. C., Schedule 1192—one 15-ton, four-motor, electric overhead traveling crane. Annapolis, Md., Schedule 1198—one steam-turbine-driven electric generator; Schedule 1196—seven high-speed, universal engine lathes. Norfolk, Va., Schedule 1187—one electrically driven gate shear machine. Applications for proposals should give the schedule desired by number.

North Central States

GOODRICH, MICH.—The Goodrich flouring mills have been purchased by Ashton Jerome and Seth Jerome. The new owners propose to remodel the mills and build a new concrete dam, and also plan to install an electric-lighting plant and supply electricity for the town.

BARBERTON, OHIO.—The Electric Rubber & Reclaiming Company is contemplating an expenditure of about $40,000 for new equipment and machinery for its plant.

BRADFORD, OHIO.—Bids will be received by L. E. Harvey, clerk of board of public affairs, Bradford, as follows: (1) For constructing pump well, pumping station, setting machinery and making pipe connections; (2) furnishing and erecting one vertical triplex power pump, 450-gal. per minute capacity. Plans and specifications are on file in the office of the clerk and at the office of A. Elliott Kimberly, engineer, 8 East Long Street, Columbus.

CALEDONIA, OHIO.—The Town Council is considering the purchase of an oil engine for the municipal electric-light plant.

CINCINNATI, OHIO.—The Hamilton County Court House Commission has applied to the Building Commissioner for a permit to install ten elevators in the new court house. The Standard Plunger Elevator Company of Worcester, Mass., has been awarded the contract for the work, at $104,000.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until June 19 for furnishing coal crusher, steam pipe and fittings and boiler gratings for the division of light and heat. Separate proposals to be submitted on each item. Specifications may be obtained at the office of the division of light and heat, Room 204, City Hall.

COLUMBUS, OHIO.—Plans are being prepared for a power plant to be erected on the campus of the State University, to cost about $200,000. Joseph N. Bradford is chief engineer and supervising architect.

KINGSTON, OHIO.—Arrangements are being made by the Scioto Valley Traction Company of Columbus to rebuild the light and power distributing system in Kingston. Material for the work, it is understood, has been purchased.

MARION, OHIO.—Preparations are being made by the Columbus, Delaware & Marion Railway Company to double the output of its local power plant.

MINERAL CITY, OHIO.—The Village Council has adopted a resolution declaring it necessary to discontinue the operation of the municipal electric-light plant and to authorize a contract with a privately owned electric plant to furnish electrical service in Mineral City. C. H. Sawyer is Mayor.

MONROEVILLE, OHIO.—The Village Council is considering a proposal submitted by the officials of the Lake Shore Electric Railway Company of Cleveland offering to furnish energy to operate the municipal electric-light plant.

SIDNEY, OHIO.—The Sidney Electric Company has filed application with the Public Utilities Commission for authority to issue $100,000 in bonds for improvements to its plant.

YOUNGSTOWN, OHIO.—The power plant of the Republic Railway & Light Company was recently damaged by an explosion, causing a loss of about $100,000. The generator, which was destroyed, will be replaced.

YOUNGSTOWN, OHIO. — Plans have been adopted by the directors of the ten subsidiary companies of the Mahoning & Shenango Railway & Light Company for merging into one company to be known as the Shenango Valley Light Company. The companies that will be included in the merger are: The Shenango Valley Electric Company, the Sharpsville Electric Light Company, the Lackawannock Township Mercer Light & Power Company, the Pymatuning Township Mercer Light & Power Company, the Shenango Township Mercer Light & Power Company, the Hickory Township Light & Power Company, the Wilmington Township Mercer Light & Power Company, the Borough of Wheatland Mercer Light & Power Company, the Borough of Farrell Mercer Light & Power Company and the West Middlesex Mercer Light & Power Company. The consolidation of these companies will be a step in the development and extensions of the company's light and power business in Mercer County.

DIXON, KY.—Steps have been taken by local citizens to organize a company to install an electric lighting plant to cost about $4,000.

HAZARD, KY.—The Kentucky River Power Company is planning to erect an electric transmission line from its Lothair power plant to furnish electricity to the coal mines in the Lott's Creek district.

CARLISLE, IND.—The Wabash Valley Electric Company of Clinton has petitioned the Town Council for a franchise and contract to supply electricity for lamps and motors in Carlisle.

FORT WAYNE, IND.—Plans have been prepared by the Fort Wayne & Decatur Traction Company for the erection of a substation, 23 ft. by 60 ft., in Decatur.

CHICAGO, ILL.—The Central Manufacturing Company, First National Bank Building, contemplates the construction of a power plant at 2015 West Thirty-ninth Street, to cost about $250,000. S. Scott Joy is architect.

EAST MOLINE, ILL.—Dr. G. F. Johnson, Mayor, has suggested to the City Council that a steam plant be installed at the water-works pumping station, and in that connection to establish a municipal electric plant for street lighting.

EDWARDSVILLE, ILL.—Work has begun on the construction of the large power plant for the Indiana Power & Water Company in Edwardsport. The general office of the company is located in Bicknell, Ind.

GALENA, ILL.—The Interstate Light & Power Company of Galena, which has completed the extension of an electric transmission line to the McMillan mine, to serve a connected load of 200 hp. in motors, is negotiating with the owners of the different mines in that vicinity to furnish electrical service.

GILLESPIE, ILL.—The Southern Illinois Light & Power Company is planning to construct a new power house and install a new equipment in Gillespie.

SPRINGFIELD, ILL.—A resolution has been adopted by the City Council authorizing the sale of $60,000 underground city electric light wire bonds and $50,000 water department amortization bonds.

WAUKEGAN, ILL.—The Public Utilities Commission has granted the Chicago North Shore & Milwaukee Railroad Company permission to issue $940,000 in bonds, the proceeds to be used for extensions and general rehabilitation of its system. At least $200,000, it is expected, will be expended for improvements to the lines in Waukegan.

FLORENCE, WIS. — The Peninsula Power Company of Chicago, Ill., it is reported, has selected a site on the Brule River in Florence for its proposed hydroelectric power plant to be built this year. Plans have not been announced. Max Sells of Florence is reported interested.

MILWAUKEE, WIS.—The City Council has granted the Milwaukee Electric Railway & Light Company a franchise for an extension on Mitchell Street to Muskego Avenue, on Muskego Avenue to Burnham Street and on Burnham Street to Twenty-sixth Avenue.

MILWAUKEE, WIS.—The Valley Steel Company is erecting an electric steel foundry and merchant bar and billet plant at St. Francis, a suburb of Milwaukee. The main structure will be 85 ft. by 680 ft. The company will manufacture steel by the electric process. Energy will be supplied by the Milwaukee Railway & Light Company.

SEYMOUR, WIS.—The Seymour Electric Company, recently incorporated, is planning to erect an electric-light and power plant. The company is capitalized at $10,000. The incorporators are: E. P. Daniels, W. E. Daniels and S. D. Newell.

TOMAH, WIS.—Plans are being considered for the installation of additional street-lighting units.

WAUPACA, WIS.—Application has been made to the State Legislature for an appropriation of $60,000 for the construction of a new power house at the Wisconsin Veterans' Home at Waupaca.

BUHL, MINN.—Contracts have been placed by the Village Council for equipment for the municipal electric-light and power plant, to cost about $25,000.

JASPER, MINN. — Edmond Shella of Letcher, S. D., has been granted a franchise to furnish electricity in Jasper for street lighting and commercial purposes.

SOUTH ST. PAUL, MINN.—Bids will be received by the Board of Education of the city of South St. Paul, Minn., until June 19 for the installation of two automatic stokers, of the underfeed type, to be installed in the High School Building at South St. Paul. J. R. Stevenson is secretary of board.

ATHENS, IOWA.—The Public Utilities Commission has granted the Athens Electric Company permission to erect an electric transmission line from Athens to Petersburg.

CORYDON, IOWA.—The Iowa Southern Utilities Company of Mount Ayr is reported to be negotiating for the purchase of the local electric plant.

DAVENPORT, IOWA. — Improvements involving an expenditure of about $400,000 to its local system are contemplated by the Tri-City Railway & Light Company. The work will include the installation of a 20,000-kw. turbine, rebuilding of electric transmission lines, installation of new equipment, etc. Energy will be transmitted from the power station at 13,200 volts instead of 4800 volts, as at present, when the improvements are completed.

EMMETSBURG, IOWA.—The Commonwealth Power Company of Mankato, Minn., has petitioned the Council for a franchise to furnish electricity for lamps and motors in Emmetsburg.

SHELDON, IOWA.—The Henry Runger cement plant is reported to have been purchased by the Sheldon Gas & Electric Company, which, it is understood, will erect a generating station there at once.

THOR, IOWA.—Bonds to the amount of $4,000 have been sold, the proceeds to be used for the installation of an electric-lighting system.

CLINTON, MO.—The municipal electric and water plant is reported to have been purchased by Morrison & McCall of St. Louis. A number of improvements are contemplated by the new owners.

FREDERICKTOWN, MO.—Negotiations are under way between the City Council and the Missouri Public Utilities Company of Cape Girardeau for the purchase of the municipal electric light plant.

HORNERSVILLE, MO.—The Arkansas Light & Power Company of Arkadelphia, Ark., has been granted a franchise to furnish electricity for lamps and motors in Hornersville.

JOPLIN, MO.—At an election to be held on June 12 the proposal to issue $225,000 in bonds for a municipal electric light plant and an alternative proposition to purchase energy from the Empire District Electric Company will be submitted to the voters.

KIRKSVILLE, MO.—At an election held recently the proposal to issue $118,000 in bonds for improvements to the municipal electric-light plant and water-works system was defeated.

LADDONIA, MO.—At an election held recently the proposal to install a lighting system in Laddonia was carried.

ST. LOUIS, MO.—The Manchu Storage Battery Company, incorporated under the laws of the State of Delaware with a capital stock of $300,000, has been authorized to utilize $140,000 to establish a plant in St. Louis.

WEBB CITY, MO.—The Southwest Missouri Railroad Company is planning to extend its electric railway from Baxter Springs, Kan., to Pilcher, a distance of 7 miles.

KEARNEY, NEB.—At an election to be held June 19 the proposal to grant a 25-year franchise to the L. E. Myers Company of Chicago, Ill., which recently took over the property of the Kearney Water & Electric Company, will be submitted to the voters. The new franchise will provide for improvements to the street-lighting system.

ALMA, KAN.—The Alma (Kan.) Light & Ice Company is reported to have been granted a franchise to install an electric-lighting system here.

ATWOOD, KAN.—Plans are being considered by the City Council for the installation of an electric-lighting system in Atwood.

BURLINGAME, KAN.—Plans are being considered by the city of Burlingame for the installation of an additional generator and engine in the municipal electric-light plant.

CONCORDIA, KAN.—The Concordia Electric Light Company is contemplating extending its electric transmission lines to Cuba, Aganda, Haddam and Washington.

HAMILTON, KAN.—The proposal to establish an electric-light system here, to cost about $6,000, is under consideration.

KANOPOLIS, KAN.—The Council is considering calling an election to submit to the voters the proposal to issue bonds for extensions to the municipal electric-lighting and water-works systems.

Southern States

LAURINBURG, N. C.—Surveys, it is reported, are being made by the Palmetto Power & Light Company for the erection of an electric transmission line from Laurinburg to a point on the Wateree River, about 7 miles from Camden, S. C., to secure energy from the plant of the Wateree Power Company. Charles E. Johnson is president.

TUXEDO, N. C.—The Blue Ridge Power Company is reported to have awarded contract for construction of a hydroelectric power plant on Green River to Willard Boggs & Company of Hendersonville. The plans provide for a development of 15,000 hp. and the erection of steel tower transmission lines from the power site to Hendersonville and Spartanburg. John A. Law of Spartanburg, S. C., is president.

BENNETTSVILLE, S. C.—The Southern Power Company contemplates the erection of an electric transmission line through Marlboro County, passing through Bennettsville, McColl and Tatum. The plans provide for the erection of a substation.

COLUMBIA, S. C.—The Columbia Railway, Gas & Electric Company is contemplating building an extension of its electric railway (between 5 and 10 miles long) to the prospective United States Army Camp site east of the city.

PACOLET, S. C.—The Pacolet Manufacturing Company is planning to equip the Pacolet Mills and the Gainesville (Ga.) Cotton Mills for electrical operation. Several hundred motors, ranging from 5 hp. to 150 hp., will be installed. Energy will be supplied by the Georgia Railway & Power Company of Atlanta, Ga., which will erect a 38,000-volt electric transmission line from the Dunlap plant on the Chattahoochee River, 3 miles distant, to the mills. About 6000 hp. will be required for the two mills. The cost of work is estimated at about $200,000.

SPARTANBURG, S. C.—At an election to be held June 12 the proposal to purchase or construct an electric-light plant will be submitted to the voters.

MARION, ALA.—The Alabama Power Company of Birmingham has petitioned the Public Service Commission for permission to purchase the plant and holdings of the Marion Electric Company.

FAYETTEVILLE, ARK.—The Fayetteville Gas & Electric Company is planning to build an addition to its power house and install additional equipment for the purpose of supplying electricity for lamps and motors to the towns of Rogers and Springdale, Ark., which will be transmitted over a transmission line 20 miles long. Specifications, it is expected, will be completed within 30 days. F. L. Oneal is superintendent.

HOXIE, ARK.—The Hoxie-Walnut Ridge Compress Company of Hoxie, recently incorporated with a capital stock of $50,000, is planning to install a power plant. S. C. Dowell, S. E. Spikes and others are interested in the project.

NEW ORLEANS, LA.—The Star Shipyards, recently incorporated, is planning to install electric cranes, pneumatic machinery and other equipment. Walter C. Keenan, Crawford Ellis and others are interested.

BILLINGS, OKLA.—The city of Billings, it is reported, will receive bids until Aug. 1 for construction of an electric-light plant, water-works and sewer system, to cost about $50,000. The Mackintosh-Walton Engineering Company, State National Bank Building, Oklahoma City, has charge of the engineering work.

CLINTON, OKLA.—Plans are being considered for the installation of an ornamental street-lighting system and placing wires underground on Frisco Avenue.

MIAMI, OKLA.—Bids will be received by the Miami Hotel Company until June 18 for the construction of a hotel, seven stories and basement, to cost about $200,000. Separate bids to be submitted on heating, electric wiring and elevators. A. J. Bellis, Orear-Leslie Building, Kansas City, Mo., is architect.

SAND SPRINGS, OKLA.—The Sand Springs Railway Company, it is reported, is contemplating the use of the surface contact system for operating its railway between Tulsa and Sand Springs to replace the overhead system now in use.

TULSA, OKLA.—The Mayor and Board of City Commissioners have approved a new ten-year contract with the Public Service Company of Oklahoma for lighting the streets, which also provides for the installation of an ornamental lighting system, consisting of 72 standards mounted with lamps of 1000 cp.

AUSTIN, TEX.—Bids will be received by Governor James E. Ferguson until June 18 for construction of five additional fireproof and two frame buildings for the State School for the Blind. Separate bids to be submitted for wiring, plumbing, heating, etc. Plans may be obtained on application to Atlee B. Ayres, Bedell Building, San Antonio, architect.

EL PASO, TEX.—The War Department at Washington has requested J. N. Gladding, city engineer, to submit estimates of cost of furnishing electricity for lighting the new cantonment to be established by the army at Fort Bliss. The army officials want to have the plant in operation by July.

SHERMAN, TEX.—The Ferguson Seed Farms have acquired a lot 150 ft. by 300 ft. with gin, consisting of eight stands and power plant, of Scott & McKnown, and have purchased an additional lot, 100 ft. by 175 ft., and will eventually use the latter for warehouses and special plants. It is proposed to overhaul gin and install additional machinery. Electric or oil power will be used.

Pacific and Mountain States

EVERETT, WASH.—According to ruling of the District Forest Department at Portland, Ore., the city of Everett holds priority, with the Pacific Pulp & Development Company second, in the matter of the water power in the Sultan River. It is now proposed that the Pacific Pulp & Development Company locate its plant in Everett, so that some amicable arrangement might be entered into whereby the city and the company could both use the water power of Sultan River.

MONTESANO, WASH. — Negotiations have been closed whereby Marshall & Company, bankers of Boston, Mass., have acquired the principal ownership of the Northwest Electric & Water Works holdings in southwest Washington, to be followed by the consolidation with the Washington Coast Utilities, a Marshall corporation, now operating on the Puget Sound. Improvements are to be made to the local plant, which will include the installation of a 700-hp. steam turbine engine, a 650-kva. generator and other equipment. The Elma and Sylvia Lake hydro plants will be kept in reserve; the local steam plant will supply service in both cities. The Washington Coast Utilities Company's plants are located at Edmonds, Richmond Beach, Vashon Island, Stanwood and Arlington.

SEATTLE, WASH.—Bids will be received by the Board of Public Works of the city of Seattle until July 20 for construction (complete) of a hydroelectric power plant; the proposed plant to have a continuous capacity of 13,000 kw., and a water supply sufficient to generate 25,000 kw. for five hours each day and 10,000 kw. for 19 hours each day. For details see proposal columns.

WALLA WALLA, WASH.—Application has been made to the County Commissioners by the Pacific Power & Light Company for a 50-year franchise to maintain electric transmission lines over certain roads in Walla Walla County.

PORTLAND, ORE.—The County Commissioners have granted the Portland Railway & Light Company a franchise to erect an electric transmission line on the Columbia River highway, subject to the approval of the district attorney, between the automobile club house and Crown Point.

FRESNO, CAL.—The San Joaquin Valley Light & Power Company is reported to be contemplating the construction of a substation, 6 miles south of Alpaugh, at a cost of $80,000. The transmission will be extended from the Corcoran power house. The new station will supply the rice fields just west of Pixley and Alpaugh and Allensworth Counties. The southern end of the new development and of the Tulare Lake Water Company will also be supplied from the new station.

LOS ANGELES, CAL.—The State Water Commission has granted the application of the Sespe Power & Light Company of Los Angeles for permission to appropriate 88 cu. ft. (second) from the Sespe River in Ventura County for power development purposes. The proposed development will involve an expenditure of $2,000,000 and will include a storage dam 175 ft. high, 2000 ft. long at the top.

OAKDALE, CAL.—An agreement has been made by the Oakdale and the South San Joaquin irrigation districts with the Sierra & San Francisco Power Company of San Francisco for furnishing electricity to operate pumps for irrigating large tracts of lands.

PORTERVILLE, CAL.—Preliminary surveys are being made by the Mount Whitney Power & Electric Company of Visalia for the construction of a new power plant near Porterville.

SAN BERNARDINO, CAL.—Plans are being prepared by the Santa Fe Railway System of Los Angeles for extensions to its locomotive and car works at San Bernardino, which will include a blacksmith shop, 45 ft. by 400 ft., a car repair building, 46 ft. by 1200 ft., and a one-story storage plant, 65 ft. by 300 ft., equipped with an electric traveling crane. G. W. Harris, Kerckhoff Building, is chief engineer.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has purchased the water rights of the Mount Shasta Power Company on the Pit River, which it is estimated will develop 180,000 hp., with a possible later development of 412,000 hp. Work on the proposed development, it is understood, will begin next year. About five years will be required to complete the project.

SONORA, CAL.—Plans have been submitted to the City Trustees for the proposed municipal street-lighting system. The use of 500-cp. lamps on Washington Street and 250-cp. lamps in other parts of the city is now under consideration.

BOVILL, IDAHO.—An election will soon be held to submit to the voters the proposal to issue $5,500 in bonds for the construction of a municipal electric-light plant. The plans call for a 25-kw. Westinghouse direct-current generator, driven by a 40-hp. semi-Diesel engine.

DEARY, IDAHO.—At a special election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

HOLLISTER, IDAHO. — The Public Utilities Commission has authorized the Idaho Power & Light Company of Boise to extend its transmission lines to the village of Hollister to furnish electricity for lamps and motors.

RONAN, MONT.—Application has been made by W. B. McDonald of the Northern Idaho & Montana Power Company of Sandpoint, Idaho, for a 50-year electric light and power franchise in Ronan. If granted the franchise the company will extend its transmission line down the east shore of Flathead and on to Ronan.

ALBUQUERQUE, N. M.—The Albuquerque Gas & Electric Power Company, recently incorporated with a capital stock of $500,000, will take over the properties of the Albuquerque Gas, Electric Light & Power Company and the Albuquerque Electric Power Company. The incorporators of the new company are: W. P. Southard, Charles S. Twogood, A. B. McMillen, Laurence Lee and D. K. B. Sellers.

Canada

EAST TORONTO, ONT.—The William Davies Company, 521 Front Street, East Toronto, is contemplating the erection of an addition to its boiler house, to cost about $6,000.

ELMIRA, ONT.—The ratepayers have approved a by-law to grant a loan of $15,000 to the Elmira Transmission Company.

PETROLIA, ONT.—The Town Council has given its first and second reading to the by-law authorizing an appropriation of $15,000 for extensions and improvements to the Hydro-Electric system.

PICKERING, ONT.—Electricity will soon be supplied through the Hydro-Electric Power Commission to Pickering Village and Pickering Township. The transmission line is to be extended westward from Whitby along the Kingston Road to the village of Pickering and thence to Claremont.

PORT ARTHUR, ONT.—Work will soon begin by J. J. Carrick, M. P., and associates, it is reported, on the erection of a pulp and paper mill just outside of the city limits of Port Arthur. The initial installation will provide for an output of 360 tons of paper per day, and will call for an expenditure of approximately $1,000,000. The mill when first put into operation will require 18,000 hp. The Ontario Hydro-Electric Power Commission, it is understood, proposes to develop Nepigon power for this purpose. Either a new substation will be erected or the present one on Hill Street will be enlarged.

PORT COLBORNE, ONT.—The Niagara District Hydro-Radial Association has forwarded a resolution to the provincial government asking that body to permit the con-

struction of the proposed electric railway from Port Colborne to Bridgeburg and from Dunnville to Port Colborne immediately, instead of waiting until after the war.

ST. THOMAS, ONT.—The Père Marquette Railroad Company has entered into a contract with the Hydro-Electric Power Commission for energy to operate its local shops.

WELLAND, ONT.—The contract for the erection of an electrode building for the Electro Metals, Ltd., at Welland, to cost about $40,000, has been awarded to W. J. Hickey, 91 Main Street, East Welland.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until June 25 for furnishing structural steel, wire rope, brass, copper, copper tubing, condenser tubes, electric wire, electric fixtures, flexible joints, washing machines, etc. Blanks and information relating to this circular (No. 1148) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Record of Electrical Patents

Notes on United States Patents issued on May 29, 1917

1,227,568. ELECTRIC SWITCH; Floyd N. Barber, Crafton, Pa. App. filed April 21, 1913. Electromagnetic.

1,227,571. ELECTRIC MOTOR; Gustav Blumberg and John A. Butkus, Baltimore, Md. App. filed Oct. 13, 1915. Motor which can run on direct currents and also on alternating currents of any number of cycles per second within the limits of frequency used in the commercial distribution of electric power.

1,227,588. ELECTRICAL CONNECTOR; John Cuthbert, Chicago, Ill. App. filed March 8, 1916. Plug.

1,227,605. ELECTRIC SWITCH; John Friis, Chicago, Ill. App. filed Nov. 2, 1914. For use with electric sign.

1,227,721. ELECTRICALLY HEATED UTENSIL; Louis H. Wilkinson and Walter G. Barker, Meriden, Conn. App. filed Dec. 11, 1916. Electrically heated unit affixed thereto by a spring and covered by a depending skirt.

1,227,726. CABLE TERMINAL; Daniel Woodhead, Chicago, Ill. App. filed Aug. 3, 1916. For use in connection with storage batteries.

1,227,752. FUSIBLE ELEMENT FOR INCLOSED ELECTRICAL FUSES; Robert C. Cole, Hartford, Conn. App. filed Oct. 27, 1916. Multiple links.

1,227,753. FUSE BLOCK; Robert C. Cole, Hartford, Conn. App. filed Oct. 27, 1916. Spring-conducting clips for receiving the terminals of inclosed fuses, loosely retained in pockets on top of the blocks.

1,227,760. THERMO-REGULATOR; Achilles de Khotinsky, Chicago, Ill. App. filed April 29, 1916. Provides a thermo-regulator of the type in which a circuit is closed by the expansion of a liquid contained therein and forming one terminal of the circuit.

1,227,766. SUSTAINING DEVICE FOR VAPOR CONVERTERS; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed July 14, 1915. Improvement.

1,227,771. BATTERY-CHARGING EQUIPMENT; Edward T. Foote, Montclair, N. J. App. filed Feb. 19, 1916. Means for charging batteries by the "across the line" or "constant-potential" method.

1,227,772. ELECTRIC DISTRIBUTING SYSTEM; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed May 6, 1915. Means for minimizing inductive disturbances in electrical circuits that may be caused by other circuits in proximity thereto.

1,227,789. ELECTRIC SWITCH; Albert J. Horton, White Plains, N. Y. App. filed April 21, 1913. Actuated to connect an ammeter in series with and a voltmeter in shunt with the circuit which is controlled by said switch.

1,227,790. CONTROL PANEL; Albert J. Horton, White Plains, N. Y. App. filed June 30, 1913. For use in controlling the charging of storage batteries.

1,227,801. ELECTRIC SWITCH; Charles J. Klein, Milwaukee, Wis. App. filed Oct. 2, 1911. Adapted to make or break a circuit with a quick snap action.

1,227,809. METHOD OF AND MEANS FOR TRANSFORMING DIRECT CURRENT; John C. Lincoln, Cleveland, Ohio. App. filed Feb. 2, 1912. To effect such transformation with a minimum loss of power.

1,227,810. MOTOR-CONTROL SYSTEM; Walter O. Lum, Wilkinsburg, Pa. App. filed April 12, 1915. Means for preventing the reversal of an electric motor while the current traversing its circuit exceeds a predetermined value.

1,227,830. PROCESS OF UNITING METAL BODIES; Archer W. Richards, Cleveland, Ohio. App. filed March 31, 1915. By electric welding.

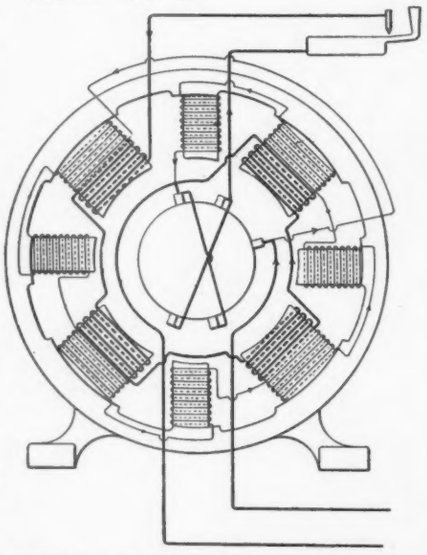
1,227,837. ELECTRIC CONTACT BOX; Arthur W. Sclater, Piccadilly, Westminster, England. App. filed Oct. 26, 1914. Provides an adjustable bridge piece.

1,227,844. VARIABLE-VOLTAGE TRANSFORMER; Arthur Simon, Milwaukee, Wis. App. filed July 3, 1915. Provides an inclosed transformer of simple, compact and durable construction.

1,227,909. PRODUCTION OF REFRACTORY MATERIALS; Paul R. Hershman, Chicago, Ill. App. filed Oct. 21, 1916. Oxide to be employed is preliminarily mixed with a certain amount of carbon and then compressed to but a slight degree.

1,227,918. PLUG AND RECEPTACLE CONNECTOR; Louis O. Lieber, Los Angeles, Cal. App. filed Feb. 3, 1916. Combination plug connector adapted for universal use.

1,227,921. ELECTRIC REGULATOR; George Machlet, Jr., Elizabeth, N. J. App. filed July 1, 1912. A prime mover to operate the regulating device under the control of the needle of the voltmeter of other indicating apparatus.



1,227,809—Method of and Means for Transforming Direct Current

1,228,028. CASING FOR LAMP SOCKETS AND THE LIKE; Charles J. Klein, Milwaukee, Wis. App. filed Dec. 18, 1913. Improved interlocking means.

1,228,032. METHOD OF ELECTRIC WELDING AND APPARATUS; Laurence S. Lachman, New York, N. Y. App. filed Oct. 24, 1916. Work is clamped by an electrode the pressure of which is applied in the direction of the welding pressure.

1,228,052. ELECTRIC SWITCH; Joseph H. Rusby, Nutley, N. J. App. filed May 22, 1913. Push-button.

1,228,058. ELECTRIC RELAY; Frederick W. Schmidt, Chicago, Ill. App. filed Oct. 19, 1914. Electromagnetic relay in which the circuit is broken between mercury and mercury.

1,228,065. CURRENT-INDICATING APPARATUS FOR DIRECT-READING WAVE-METERS FOR HIGH-FREQUENCY OSCILLATIONS; George Seibt, Berlin, Germany. App. filed Oct. 18, 1911. Will also serve the purpose of a safety fuse for protecting the wave meter.

1,228,075. CONTROLLING SYSTEM FOR ELECTRIC ELEVATORS; William S. Smith, Cambridge, Mass. App. filed March 28, 1916. Push-button system.

1,228,097. ELECTRIC RELAY; James B. Crippen, Chicago, Ill. App. filed Oct. 30, 1916. Tensionless armature with but two positions of rest.

1,228,127. CONDUIT OUTLET BOX; Edwin A. Olley, Syracuse, N. Y. App. filed May 25, 1911. Means for coupling boxes to the conduits without turning the boxes or the conduits.

1,228,142. HIGH-TENSION INSULATOR SUPPORT FOR BUSBARS; Edson O. Sessions, Chicago, Ill. App. filed Aug. 16, 1915. Improvement.

1,228,155. POTHEAD; Paul F. Williams, Chicago, Ill. App. filed Sept. 18, 1912. Casing is provided with removable members by which access can be gained to its interior.

1,228,156. CONNECTOR FOR ELECTRICAL CONDUCTORS; Paul F. Williams, Chicago, Ill. App. filed March 17, 1913. Involving a tubular or hollow casing or housing for an end portion of one of the conductors to be terminated or connected.

1,228,169. MANUFACTURE OF ELECTRODES; Edmund H. Becker, Washington, D. C. App. filed Sept. 27, 1916. Composed of a granular copper oxide material, the granules consisting of an intimate and homogeneous mixture or combination of cupric oxide and cuprous oxide.

1,228,188. PRESSURE REGULATOR; Frederick S. Denison, Minneapolis, Minn. App. filed June 29, 1916. Pressure gage having means connected with the thermostatic circuit so that when the pressure reaches a predetermined point the circuit will be closed through the motor to shut off the draft, even though the thermostatic bar may still be in contact with the "cold" side of the thermostat.

1,228,195. AUTOMATIC CIRCUIT CLOSER FOR ELECTRIC HEATERS; Michael H. Farley, Seattle, Wash. App. filed March 23, 1916. Automatic thermostatic switch or controller for use in connection with an electric sadiron.

1,228,243. WATER HEATER; Frederick Poole, Jewell, Kan. App. filed Feb. 2, 1915. Instantaneous.

1,228,250. STORAGE-BATTERY CONSTRUCTION; James M. Skinner, Philadelphia, Pa. App. filed May 11, 1916. Maximum proportion of active material in the external surface and parts adjacent thereto in the finished plate or electrode.

1,228,330. OUTLET BOX; Clyde H. Loughridge and Howard R. Loughridge, Pittsburgh, Pa. App. filed Sept. 24, 1915. Improvements.

1,228,337. ELECTRICAL ATTACHMENT PLUG; Philip S. McLean, Bloomfield, N. J. App. filed April 4, 1916. Swivel type.

1,228,340. PORTABLE FIREPLACE; Charles Maynard, Milan, Mich. App. filed Oct. 25, 1916. Heater is so designed as to retain foodstuffs in a heated or warm condition.

1,228,354. ELECTRICAL FUSE; Harry W. Young, Chicago, Ill. App. filed Sept. 26, 1914. Removable fuse cartridges.

1,228,359. NON-HYDRATED MOISTURE-CONTAINING MANGANESE DEPOLARIZING COMPOUND; Carleton Ellis, Montclair, N. J. App. filed Oct. 23, 1915. Depolarizers of the type suitable for use in dry batteries of the Leclanché type.

1,228,362. SWITCHBOARD OR MOUNTING; John P. Hayes, Pittsburgh, Pa.; App. filed Oct. 5, 1914. Provides ample room and capacity for attachments and connections of the various conductor elements, with economy of material and space.

1,228,368. WOOD SEPARATOR FOR STORAGE-BATTERY PLATES; William Morrison, Chicago, Ill. App. filed Nov. 11, 1916. The pores of the wood are filled to a large degree with the precipitated barium salt.

1,228,369. SEPARATOR FOR STORAGE-BATTERY PLATES; William Morrison, Chicago, Ill. App. filed April 2, 1917. The pores of the separator are filled to a large degree with the precipitated strontium salt.